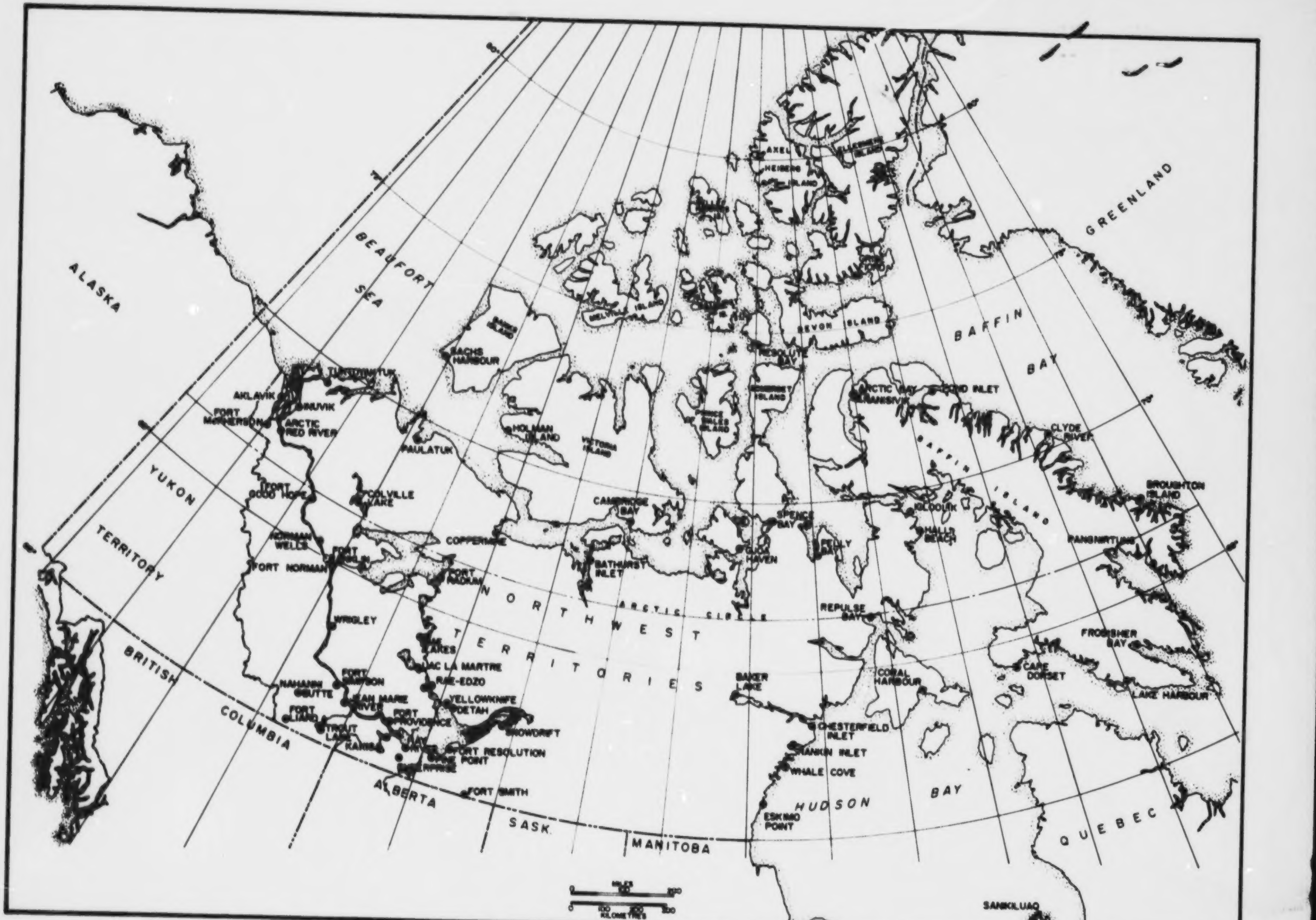
ALASKA
BEAUFORT SEA
YUKON TERRITORY
BRITISH COLUMBIA
ALBERTA
SASK.
MANITOBA
QUEBEC
GREENLAND
BAFFIN BAY
HUDSON BAY
NORTHWEST TERRITORIES
ARCTIC CIRCLE
AXEL HEIBERG ISLAND
ELLESMERE ISLAND
GRISE FIORD
DEVON ISLAND
MELVILLE ISLAND
BANKS ISLAND
SACHS HARBOUR
HOLMAN ISLAND
VICTORIA ISLAND
PRINCE OF WALES ISLAND
SOMERSET ISLAND
RESOLUTE BAY
ARCTIC BAY
NANISIVIK
POND INLET
CLYDE RIVER
BAFFIN ISLAND
BROUGHTON ISLAND
PANGNIRTUNG
IGLOOLIK
HALL BEACH
PELLY BAY
SPENCE BAY
GJOA HAVEN
CAMBRIDGE BAY
BATHURST INLET
REPULSE BAY
CORAL HARBOUR
FROBISHER BAY
CAPE DORSET
LAKE HARBOUR
BAKER LAKE
CHESTERFIELD INLET
RANKIN INLET
WHALE COVE
ESKIMO POINT
SANIKILUAQ
TUKTOYAKTUK
AKLAVIK
INUVIK
FORT McPHERSON
ARCTIC RED RIVER
PAULATUK
FORT GOOD HOPE
COLVILLE LAKE
NORMAN WELLS
FORT FRANKLIN
FORT NORMAN
COPPERMINE
FORT RADIUM
WRIGLEY
LAC LA MARTRE
RAE-EDZO
YELLOWKNIFE
DETAH
SNOWDRIFT
FORT RESOLUTION
PINE POINT
HAY RIVER
ENTERPRISE
FORT SMITH
FORT SIMPSON
NAHANNI BUTTE
JEAN MARIE RIVER
FORT PROVIDENCE
FORT LIARD
TROUT LAKE
KAKISA
MILES
0
100
200
0
100
200
300
KILOMETRES

COMMUNITY WATER & SANITATION SERVICES

NORTHWEST TERRITORIES

Prepared By:

EPEC Consulting Western Ltd.
Under the Authorization and Direction of
The Water and Sanitation Section,
Department of Local Government,
Government of the Northwest Territories

NOVEMBER 1981

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- Staff of the Water Resources Division, DIAND and the Department of National Health and Welfare for providing community information and data;
- Ken Briggs, EPEC Consulting Western Ltd., who prepared the graphics for aerial photographs and figures in the report;
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N.A. Jacobsen, P.Eng.
EPEC Consulting Western Ltd.

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To the Reader:

One of the highest priorities of my Department has been to foster the development of a safe and sanitary community environment in which the people of the Northwest Territories may live. This is not always easy, and in Northern Canada costs are often very high.

The past few years have also been a particularly active period in the Northwest Territories with progress often being very difficult to gauge. However, upon overall reflection one often finds that while much work remains, considerable advances have, in fact, been made.

This is certainly the case with the improvements made in the level of water and sanitation services in the Northwest Territories and I am sure that this inventory report will be a timely enlightenment for the reader.

This report will also give those persons unfamiliar with our Northern Communities a better appreciation of the range of environmental conditions and the needs for improved water and sanitation services in the Northwest Territories.

I am sure you will find this report to be a storehouse of valuable community information.

James J. Wah-Shee
Minister

ᐅᖃᓕᒫᕐᑐᒧᑦ :

ᑑᑯ ᒐᐸᒪᒃ ᑯᑦ ᐱᓕᑎᐊᑎᓇᓯᐊᕐᑕᖁᑦ ᐃᓕᖁᑦᑕᒪᓐᓇ ᓄᑖᓂᑦ ᐊᒃᑕᑯᕐ ᐱᒃᑖᕐᓂᕐ ᐊᒻᒪᓗ ᐊᑲᐅᓂᕐᐸᒃ ᑯᑦ ᐃᒥᕐᑕᖃᑦ ᑕᕐᓂᕐ ᐃᓄᐃᑦ ᐃᒡ ᑐᕐᓐ ᓄᑦ ᓯᓕᑎᑦ ᑎᓐᓂ ᑕᒫᓂ ᓄᓇᑦᓯᐊᒥ. ᐊᒻᒪᓗ ᑕᒪᓐᓇ ᐊᔪᕐ ᓇᕐ ᓂᐊᕐ ᒥᕐ ᒪᑦ ᐊᕙᒐᓯᐊᕐ ᓗᒍ ᓯᓇᑐᐃᓐᓇᐃᑦ ᐊᑭᑦ ᑐᕐᐸᑦ ᓕᐊᒃ ᐸᕐᒪᑕ.

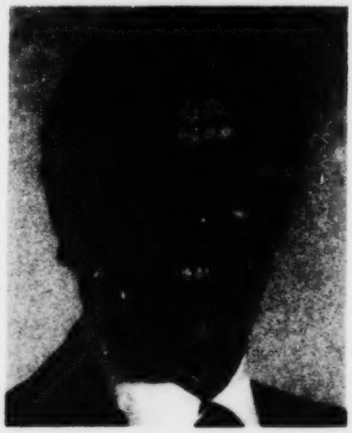
ᐊᕋᒍᔪᓂ ᑕᒃ ᑯᓇᓂ ᐊᑐᓕᕐᑐᓂ ᐱᕙᑦ ᓕᐊᔪᑦ ᐊᒥᓯᕐᒪᑕ ᐃᓕᓐᓂᒃ ᑯᑦ ᐊᔪᕐ ᓇᕈᔪᒃ ᐸᒃ ᓯᑎᒃ. ᑭᓯᐊᓂᑦ ᑕᐅᕐ, ᐱᓕᑎᐊᒃ ᓴᐃᑦ ᐊᒥᓯᒐᓗᐊᕐᑎᑦ ᓗᒥᑦ ᐊᕿᒃ ᐸᑦ ᓕᐊᔪᑦ ᑕᐅᕐ ᐊᒥᓯᕐ ᒥᔪᑦ.

ᐊᕿᒃ ᓯᕐᑕᐅᓇᓯᐊᕐᑐᑦ ᑕᒪᒃ ᑯᐊ ᐊᒃᑕᑯᕐ ᐱᒃᓴᐃᑦ ᐊᒻᒪᓗ ᐃᒥᕐᑕᕐ ᐱᒃᓴᐃᑦ ᓄᑖᑦ ᓴᕿᕐᐸᑦᓕ ᐊᓂᕐᑦ ᓄᓇᑦᓯᐊᓂ ᑕᑯᒃ ᓴᐅᔭᑦ ᕐᑲᐱᐊᒥᔭᐅᓂᐊᕐᑯᑎᑦ ᓗᓂ ᐅᖃᓕᒫᕐᑐᒧᑦ ᑕᒪᓐᓇ ᐅᓂᒃ ᑲᑎᓂᐊᕐ ᑕᕋ .

ᑕᓐᓇᑦ ᑕᐅᕐ ᐅᓂᒃ ᑳᓕᐊᒃᒍᓯᒪᔪᕐ ᐅᑭᐅᕐᑕᕐᑐᒥᓕᕋᑖᓄᑦ ᖃᐅᔨᒃ ᔪᑕᐅᕙᑦ ᓕᕈᓐᓇᕐᒪᑦ ᐊᒻᒪᓗ ᐅᑭᐅᕐᑕᕐᑐᒥᐅᑕᐃᑦ ᓄᓇᒥᔭᐅᔪᓂ ᐊᒃᑕᑯᓕᒥᓂᐅᑉ ᐊᒻᒪᓗ ᐃᒥᕐᑕᕐᓂᐅᑉ ᖃᐅᔨᕙᓪᓕᕈᑕᐅᔪᓐᓇ ᕐᒪᑦ ᐊᑭᒥ ᐊᕐᑕᐅᔭᑎᐊᓖᑦ ᒥᒃ ᓵᓄᑦ ᑕᒪᓂ ᓄᓇᑦᓯᐊᓂ.

ᑕᓐᓇ ᖃᐅᔨᕙᓪᓕᕈᑎᒥᓂᐊᕋᐱᐅᑉ ᖃᐅᔨᒪᔭᐅᔭᑎᐊᓕᒃ ᑐᓴᒃᓴᕐ ᓄᓇᑦᓯᕐᓄᑦ.

James J Wah-shee
ᔩᒥᔅ ᕚᔩ
ᒥᓂᔅᑕᐅᑉ



To the Reader:

Subject: Northwest Territories — Community Water, Sanitation
and Related Facilities and Practices 1981

On numerous occasions, the Department of Local Government receives varied requests for information of a general nature regarding facilities and practices that are in place in the communities across the Northwest Territories. The information requests come primarily from the general public, academic institutions, professional consultants, other Provincial or Federal Government Departments, and municipal administrations.

Quite often it is necessary to carry out an extensive file search to assemble the requested information or to consult a variety of sources to compile a reply. Needless to say, this is a very time consuming exercise and results in less than optimal use of very limited staff.

It was therefore decided to prepare the attached "Inventory Report"; the hope being that it would provide quick and ready reference for a wide range of general questions regarding community water and sanitation facilities and practices in the Northwest Territories.

To most general information requests, we can now simply provide a copy of this report. It is envisaged that this report would be updated every four years approximately.

The reader will be quick to note that the standard of water and sanitation facilities in the Northwest Territories communities is, in many cases, considerably inferior to that enjoyed by most communities in southern Canada. Progress is being made in this regard though, through the very aggressive and generous provisions of the Northwest Territories Government Water and Sanitation Program. Many improvements have been implemented particularly in the past four years with total capital expenditures varying from eight to fourteen million dollars annually. The reader is referred to a similar report entitled "North of 60 — Report on Municipal Services in Communities of the Northwest Territories", prepared by Dr. G. W. Heinke of the University of Toronto for the Department of Indian and Northern Affairs in 1973, to view the level of improvement that has been made since that time.

In general, the priorities of the Water and Sanitation Program for the smaller Northwest Territories Communities have been to, firstly improve their ability to distribute sufficient quantities of potable water and to collect and haul away the sewage and garbage. The second priority has been to ensure each community has a sufficient water supply that satisfies all of the bacteriological, chemical, and esthetic standards set out in the Guidelines for Canadian Drinking Water Quality as well as to provide an all season water intake to ensure a safe and ready supply. The upgrading of solid waste facilities and sewage treatment and disposal facilities normally follow in order of priority.

It is also noteworthy that considerable capital construction work has been sponsored by the Water and Sanitation Program in the larger communities. Although most of the larger communities enjoy piped water and sewer service, upgrading and expansion of the major infrastructure components has been necessary to accommodate the demands of a growing population.

It is hoped this report will provide some insight to the direction of the Northwest Territories Water and Sanitation Program as well as provide a ready reference as to the current water, sanitation, and related facilities and practices in the various Northwest Territories Communities.

Larry Elkin
Deputy Minister

ᐅᖃᓕᒫᕐᑐᒧᑦ :

ᐅᓂᒃ ᑲᑎᔭᐅᔪᖅ: ᓄᓇᑦ ᓯᐊᓂ- ᓄᓇᒥᔭᐅᔪᓂ ᐃᒥᕐᑕᕐ ᓂᖅ, ᐊᒃ ᑕᑯᕐ ᐱᓕᕆᓂᕐ ᓗ ᐊᒻ ᒪᓗ ᐊᓯᖏᑦ ᐊᒻ ᒪᓗ ᐱᓕᕆᐊᕆᔭᐅᓂᐊᕐᑐᑦ 1981-ᒥ

ᐊᒥᐊᓯᐊᕐᑎᓗᐊᕋᑎᒃ ᐃᓕᒃ ᑕᒃ ᑯᐊ ᑑᑯ ᒐᕙᒪᒃ ᑯᑦ ᑎᑎᕋᕐ ᕕᐅᖃᑦ ᑕᕐᓯᒪᓕᕐ ᒪᑕ ᐅᖃᓚᕕᐅᖃᑦ ᑕᕐᓯᒪᓕᕐᓯᑎᒃ ᓗ ᑐᓴᕈᒪᔪᓄᑦ ᖃᓄᕋᓗᒃ ᑕᒪᒃ ᑯᐊ ᐱᓗᐊᕐᑐᒥᒃ ᐱᓕᕆᐊᕆᓪᓚᑦ ᓚᐊᓂᖏᖅ ᓄᑦ ᓄᓇᒥᔭᐅᔪᓂ ᓄᓇᑦ ᓯᐊᓂ. ᑕᒪᒃ ᑯᐊ ᑐᓴᕈᒪᔪᑦ ᑭᒃ ᑯᑐᐃᖅ ᓇᕈᔪᕝ ᑐᑦ, ᐃᓚᖅ ᓂᐊᕐᕕᑦ, ᐃᓚᓴᕐᓯᒪᔪᑦ ᖃᐅᔨᒪᔪᑦ ᐃᑲᔪᕐᕖᑦ, ᑲᓇᑕᐅᑉ ᐊᕕᒃ ᑐᕐᓯᒪᓂᖏᑦ ᑕ ᒐᕙᒪᓕᕆᔨᖏᑦ, ᑲᓇᑕᒃ ᑯᑦ ᒐᕙᒪᓕᕆᕖᖏᑦ, ᐊᒻ ᒪᓗ ᓄᓇᓕᕐ ᓂ ᒐᕙᒪᒥᔭᐅᔪᑦ ᐊᐱᕐᓱᕐᐸᒃ ᑐᑦ.

ᐃᓚᖅ ᓂᑲᓴᓪ ᒪᑎᒃ ᑯᑦ ᑕᒪᒃ ᑯᐊ ᖃᐅᔨᒪᔭᐅᔪᒪᔪᑦ ᐊᔪᕐᓇᕐᓱᖅᕝ ᑐᑕᓗᐊᑦ ᕿᓂᑎᐊᖃᕐᓱᒃ ᒪᑕ ᐊᒃ ᓯᓪ ᒪᑎᒃ ᐅᑉ ᐸᓗᖅᓂᑦ ᐅᖃᐅᕐ ᔭᐃᕈᓂᒃ ᐅᖃᖃᑎᒥᖃᑦ ᓯᒥᑦ ᐱᐸᒃ ᑲᑦ ᑕ ᑭᐅᓚᐅᖃᑦ ᑎᖅ ᓇᑕ. ᐅᖃᑎᐊᒃ ᑲᖅ ᓂᕐ ᓯᒍ ᑕᒪᖅᓇ, ᑕᒪᖅᓇ ᑭᐅᒪᓯᐊᑦ ᓂᕐ ᕿᓂᑦ ᓂᕐ ᑭᐅᕐ ᔪᑎᒃ ᓴᓂᒃ ᐊᔪᑦ ᓇᕐᓱᕐ ᒪᑦ ᐊᑯᓂᐅᕋᓗᒃ ᓯᓂᓗ ᐱᕐᓱᕐ ᒪᑦ ᐊᒥᓯᒪᑎᒃ ᓗ ᑕᒪᒃ ᑯᐊ ᖃᐅᔨᒪᓪ ᓚᑎᒃ ᑐᑦ ᐃᖃᓇᐃᔭᕐᑎᔪᑦ.

ᑕᐃᒪ ᐊᕿᒃ ᓯᒥᐊᓚᓚᐅᕐᐳᑦ "ᐅᓂᒃ ᑳᓚᐊᒥᒃ"; ᐃᑲᔪᑕᐅᔪᖅᓇᕈᖅᓇᕐᑯᕐ ᓗᒍ ᑐᐊᕕᐅᔭᐅᔪᓄᑦ ᑐᓴᕐᑕᐅᔪᒪᕐᔪᒍᔪᓄᑦ ᐊᒃ ᑕᒎᑦ ᐊᒻ ᒪᓗ ᐃᒪᓕᕆᓂᐅᑉ ᒥᒃ ᓴᓄᑦ ᓄᓇᑦ ᓯᐊᓂ.

ᑐᓴᕐᑕᐅᔪᒪᔪᒃ ᑐᓄᑦ ᑕᐃᒪ, ᑕᑦ ᓯᒍᖅᕝ ᐅᖅᓂᑳᓚᐊᕐᔪᔪᑦ ᑕᑯᒥᐊᕝᑭᖅᓇᓯᐳᑦ ᐊᒃ ᐹᓚᐊᖏᖅᓄᑦ. ᑕᒪᖅᓇ ᐊᕿᒃ ᓯᕐᑕᐅᔪᖅᓇᓂᐊᕐᑐᒃ ᓴᐅᖑᕐ ᐊᕋᒍᐃᑦ ᓯᑕᒪᑦ ᓇᒥᕋᐃᕝᑕ ᓄᑖᓂᒃ ᐊᕿᒃ ᓯᐃᓪᓚᒃ ᓗᑎᒃ ᐅᓂᒃ ᑳᓚᐊᕐᔪᔪᓂᒃ.

ᐅᖃᓕᒫᕐᑐᕐ ᖃᐅᔨᓇᑎᑦ ᓂᐊᕐᑐᒃ ᓴᐅᖑᕐ ᓄᓇᑦ ᓯᐊᓂ ᐊᒃ ᑕᒎᓚᑎᓂᕐ ᐊᒻ ᒪᓗ ᐃᒪᓕᑎᓂᕐ ᓯᕐ ᑲᐃᖅᓂᕐᓴᐅᔪᔭᑦ ᒪᑦ ᑕᒫᓂ ᖃᑦ ᓗᓇᑦ ᓄᓇᑯᑎᖏᖅ ᓂᐅᕝᓂ. ᐱᓪᓚᑦ ᓚᐊᔪᓚᓗᐊᑦ ᑕᒫᓂ ᐊᑲᐅᓂᕐᓴᐅᔪᒥᒃ, ᑕᒃ ᑯᐊ ᓄᓇᑦ ᓯᐊᑦ ᒐᕙᒪᒃ ᑯᖏᑦ ᑕᒪᑐᒥᖅᕝ ᐊᒃ ᓯᕿᑎᖃᑦ ᒪᑕ ᐊᒃ ᑕᑯᓚᑎᑦ ᓯᐊᑦ ᓂᐅᑉ ᐃᒥᕐᑕᑦ ᓯᐊᑦ ᓂᐅᑦ ᓗ ᒥᒃ ᓴᓄᑦ ᐱᓕᕆᐊᕆᔭᖅᓄᑦ. ᐊᒥᓯᑦ ᐊᕿᒃ ᑕᐅᓯᓚᕐᑐᕐ ᐱᓗᐊᕐᑐᒥᒃ ᐊᖑᒍᐃᑦ ᓯᑕᒪᑦ ᐅᓚᕐᑐᓂᒃ ᖃᐃᕐᓯᒪᓚᕐᑐᓂᒃ, ᑮᓇᐅᔭᐃᑦ ᐅᓚᒃ ᔪᕐᑎᒃ ᓴᓄᑦ ᐅᑐᒻ ᒪᑎᒃ ᑐᓄᑦ ᐅᑦ ᓂᖃᓚᕐᑐᑦ 8-ᓗ 14-ᓗ ᒥᓚᐊᖅᑕᓚᓂᒃ ᐊᒃ ᑕᒎᓚᑎᓂᑦ ᒧᑦ ᐃᒥᕐᑕᑦ ᓂᑦ ᒧᑦ ᓗ ᐊᖑᒍᓚᒪᕐ. ᐅᖃᓚᒪᕐᑐᕐᑕᐅᕐ ᖃᐅᔨᑎᒍᒪᑦ ᒥᔭᐳᑦ ᐅᓂᒃ ᑳᓚᐊᕐᔫᓯᒪᔪᒥᒃ ᐊᕿᒃ ᑕᐅᓚᐅᕐᑐᒥᒃ ᐃᒫᒃ ᐊᑎᖃᑦ ᑐᕐ "North of 60-ᐅᓂᒃ ᑲᓚᐊᑦ ᓄᓇᓕᕐ ᓂ ᐱᓕᕆᐊᕆᔭᐅᔪᒪᔪᑦ ᐱᓕᕆᐊᕆᔭᐅᔪᑦ ᓄᓇᑦ ᓯᐊᓂ", Dr. G.W. Heinke ᐊᕿᒃ ᓯᓚᐅᕐᑕᖅ ᑕᐅᓇᓂ ᖃᑦ ᓗᓇᑦ ᓄᓇᖅᓇᓂ ᐃᓚᖅ ᓂᐊᑦ ᐱᓪ ᔪᐊᖅᓇᓂ Torontoᑉ ᐃᓄᓚᑎᕗᑐᖃᒃ ᑯᖅᓄᑦ ᐃᓚᖅᓗᓂ 1973-ᒥ ᐊᕿᒃ ᑕᐅᓚᐅᕐᓯᒪᔪᕐ, ᖃᐅᔨᑉ ᔪᑕᐅᔪᖅᓇᕐᑯᕐ ᓗᒍ ᖃᓄᓚᑎᒃ ᐊᑲᐅᓂᕐᓴᐅᓚᑦ ᒪᖅᑕ ᑕᐃᑦ ᓯᒪᓂᑦ ᒥᐅᖅᓂ.

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ᐊᐃᑉᐸ ᑕᐃᒪ ᐱᓕᕆᐊᕆᔭᐅᕙᒪᕙᖅ ᐃᒥᖅᑕᕆᔭᐅᓯᖕᒍᕙᑦ ᐃᒡ ᓗᓄᑦ ᓇᒻᒪᒃ ᑲᓗᐊᑉ ᒪᖏᖅ ᖃᓂᒻᒪᒃ ᑕᐃᓕᒪᓇᖅᑐᓂᒃ ᐃᓕᒥᐊᕿᑎᖃᑦ ᓯᐊᖁᓗᐊᑉ ᒪᖏᑕ ᐊᖅᑭᒃ ᑕᐅᕙᒪᕐ ᒥᕐ ᒪᑦ ᑕᒪᓐᓇ ᐊᖁᒍᕙᐃᑦ ᖃᖏᖅᐸᓪᓕᐊᑎᓪ ᓗᒥᑦ. ᐊᒃ ᑕᑯᓕᕆᓂᑉ ᓕ ᑕᒪᓐᓇ ᐊᖅᑭᒃ ᓯᖅᑕᐅᓯᖕᒍᕗᑦ ᐱᓗᐊᖅᑐᑦ ᓯᕗᓪ ᓕᐅᑎᓗᐊᖅᑕᐅᓪ ᓗᑎᒃ.

ᖃᐅᔨᕙᒪᓐᓇᕐ ᓂᐊᖅᑐᒃ ᓴᐅᒥᕗᖅ ᑮᓇᐅᔭᐃᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᐃᖃᓇᐃᔭᖅᑐᒃ ᓴᓄᑦ ᑕᒃ ᑯᓄᖓ, ᐊᒃ ᑕᑯᓕᕆᓂᑉ ᒧᑦ ᐊᒻ ᒪᓗ ᐃᒥᖅᑕᑉ ᓂᑉ ᒧᑦ ᐱᓕᕆᐊᕆᔭᐅᕙᒧᑦ ᐊᑭᓕᖅᑕᐅᕙᓐ ᓇᑉ ᓂᐊᑉ ᒪᑦ ᓄᓇᒥᔭᐅᕙᓂ ᐊᖏᓂᖅᓴᐅᕙᓂ. ᑕᒪᒃ ᑯᐊ ᓄᓇᓕᑦ ᐊᖏᓂᖅᓴᐃᑦ ᓯᑦ ᑐᒃ ᑯᑦ ᐃᒥᖅᑕᖅᑕᐅᓯᖕᒍ ᕙᑦ ᐊᒃ ᑕᑯᑉ ᐱᓕᕆᔭᐅᓯᑦ ᑐ ᓯᑦ ᑐᒃ ᑯᑦ ᖁᐱᐊᒥᔭᖃᖁᑉ ᒪᑕ, ᑕᐃᒪᑦ ᑕᐅᖅ ᐊᒥᓱᖑᑉ ᐸᑦ ᓕᐊᓂᖏᑦ ᐃᓄᐃᑦ ᐃᖃᐅᒪᔭᐅᔭᑎᐊᖃᑉ ᒪᑕ ᐊᖅᑭᒃ ᓯᖅᑕᐅᔭᑎᐊᖃᓕᑉ ᒥᕙᑦ ᐊᒥᓱᖑᑉ ᐸᑦ ᓕᐊᒃ ᒪᑕ ᓄᓇᓕᑉ ᓂᑦ ᑐᑦ ᐊᖏᓂᖅᓴᓂ.

ᑕᐃᒪ ᑕᓐᓇ ᐅᓂᒃ ᑲᓕᐊᖅᒍᓯᒪᔭᖅ ᐃᑲᔭᑕᐅᔭᓐᓇᑉ ᓂᐊᖁᓯᒥᕙᕗᑦ ᖃᓄᑉ ᓗ ᑐᖁᑉ ᓂᖃᖁᓗᐊᑉ ᒪᖏᑦ ᑕ ᐃᒪᓕᕆᓂᐅᑉ ᐊᒻ ᒪᓗ ᐊᒃ ᑕᑯᓕᕆᓂᐅᑉ ᒥᒃ ᓴᓄᑦ ᓄᓇᑦ ᓯᐊᑉ ᓄᓇᖅᑯᑎᖏᓐᓂ.

ᓕᐅᕆ ᐃᐊᓪ ᑭᓐ
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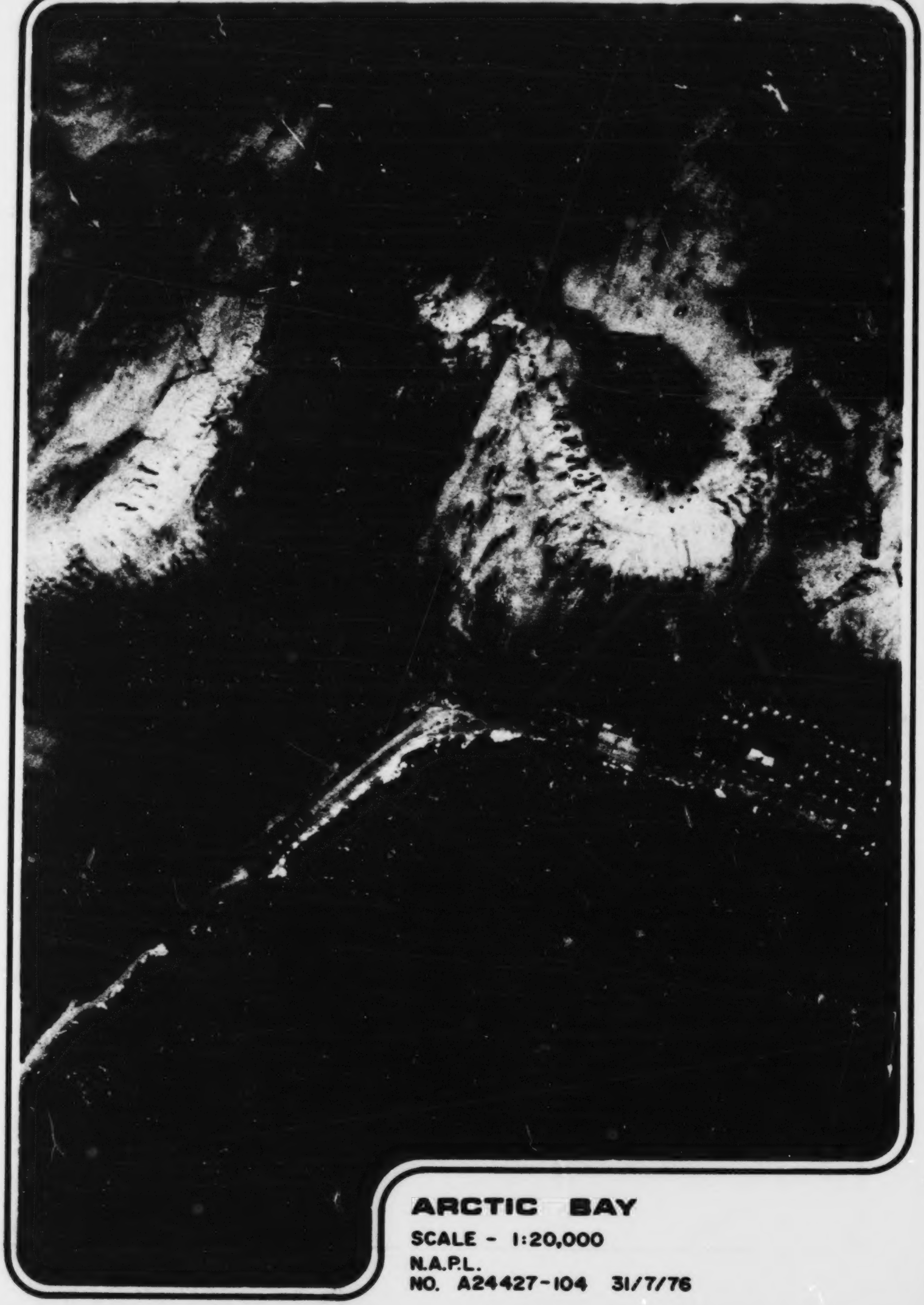
BAFFIN REGION

Arctic Bay



ARCTIC BAY

SCALE - 1:20,000

N.A.P.L.
NO. A24427-104 31/7/76

Hamlet of Arctic Bay

A. GENERAL

A.1 Location

Arctic Bay is located on the northern end of Baffin Island at approximately 73°02'N and 85°11'W. It is the most northerly community on Baffin Island and is about 1216 air km northwest of Frobisher Bay.

A.2 History

This community was named after the whaling vessel 'Arctic Bay' commanded by Captain William Adams who first visited the Bay in 1872. The Hudson's Bay Company established a trading post at the site during the 1920's. In 1942, the Department of Transportation built a weather station. A school was built by the Federal Government in 1962. There has been a gradual development of the community since that time.

A.3 Community Information

Arctic Bay became a Hamlet in July of 1976. The 95% Inuit population has remained generally stable from 1978 to 1980 with 403 to 401 persons respectively.

The economy is based on wages and handicrafts as well as traditional fishing and hunting. Nanisivik Mines provides employment for a large number of the men. Panarctic also provides some employment from petroleum exploration activities.

Air service is intermittent due to M.O.T. landing restrictions. The airstrip located adjacent to the Hamlet is 490 m x 23 m and surfaced with soil consisting of decayed shale.

A.4 Geology and Terrain

There are some grassy areas on a talus base intermixed with clay in the southern half of the community. The beach consists of 6 m to 20 m of gravel.

Subsurface conditions range from clays mixed with gravel to humus and tundra over continuous permafrost. On the hill rising to lake 'X' colluvial soils are present. There is also some evidence of slow creep (see aerial photo).

A.5 Vegetation

Tundra vegetation consists of arctic willows, grasses, mosses and lichens growing on the humus in the southern part of the Hamlet.

A.6 Climate

Arctic Bay experiences long cold winters and short cool summers. The January high and low temperatures are -25.8°C and -35.5°C respectively. The July high and low are 10.1°C and -2.1°C. Freeze-up is in September while break-up occurs in July. Prevailing winds are from the north-northwest. Total annual precipitation averages 12.5 cm.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

At the present time there are two sources of water.

During the summer a 50 mm plastic line connects Lake "X" to the community approximately 1000 m distant as shown in the aerial photo. Lake "X" is situated above the community and the water flows by gravity siphon. In the winter water is trucked from Marcil Lake, located approximately 6 km southeast of the community along the road to Nanisivik. Both sources provide water of acceptable quality.

During 1980, construction was completed of the first stage of a project to provide a year-round water supply from Lake "X" and is designed to meet the requirements of Arctic Bay until 1998. The project stages are described briefly as follows:

1980 - Stage A - Intake and prime station

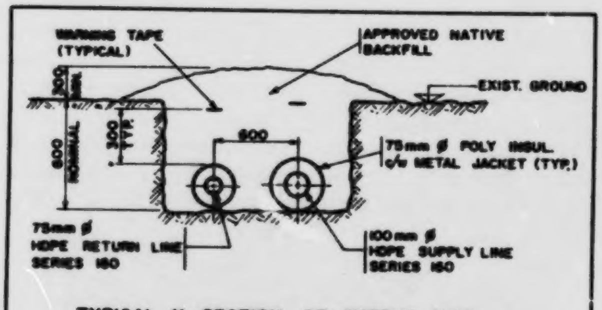
1980 - Stabe B - Dual transmission mains from Lake "X" to the Hamlet.

1982 - Stage C - Terminal facilities and terminal storage in the Hamlet.

B.1.2 Source

Both lake 'X' and Marcil Lake are of good chemical quality. A typical analysis is as follows: (All values in mg/L unless otherwise noted)

PARAMETER	MARCIL LAKE	LAKE 'X'
Nitrate-Nitrogen	0.07	<0.02
Ammonia as N	<0.05	0.14
Sulphate (SO_4)	4.00	6.50
Chloride (Cl)	1.70	6.70
Total Hardness (as $CaCO_3$)	7.40	91.00
pH	7.60	8.30
Turbidity (NTU)	15.00	2.00
Color (APHA)	20.00	5.00
Conductivity	66.0	252.00
Calcium (Ca)	1.50	18.00
Iron (Fe)	0.41	0.10
Potassium (K)	0.40	0.50


WARNING TAPE (TYPICAL)
APPROVED NATIVE BACKFILL
EXIST. GROUND
300 MIN.
600 NOMINAL
300 TYP.
600
75mm ø POLY INSUL. c/w METAL JACKET (TYP.)
75mm ø HDPE RETURN LINE SERIES 160
100mm ø HDPE SUPPLY LINE SERIES 160

TYPICAL X-SECTION OF SUPPLY MAIN

N.T.S

B.1.3 Intake Facilities and Supply Line

The new intake structure will extend about 162 m into Lake 'X' and will be situated approximately 2.5 m below the water surface. The intake pipe details include a 150 mm HDPE series 160 supply pipe enclosed in a 250 mm steel pipe, schedule 60 with 25 mm polyurethane insulation covering.

The screened intake will draw water from about 0.5 m above the lake bottom. The intake will connect to the prime station located at the south end of the lake. A syphon effect will draw the water over the slight hill at the south end of the lake and down the supply line.

Lake 'X' is located approximately 100 m higher in elevation than the terminal facilities. The tank will be filled by gravity syphon through the transmission main.

The transmission main consists of two pipes - a supply pipe and a smaller return pipe. Specifications for the supply pipe are as follows:

Length:	1000 m
Type:	HDPE Series 160
Diameter:	100 mm
Insulation:	75 mm polyurethane, c/w 22 gauge lock-seam spiral wound steel jacket

Return Pipe - 75 mm diameter - same materials specifications as for the supply pipe.

Access to each pipe has been provided at 60 m intervals to allow thawing with a tube and heated water.

B.1.4 Treatment

A hypochlorinator will be included in the terminal facilities located in the Hamlet. It will consist of a flow meter-paced chemical pump system using calcium hypochlorite solution.

B.1.5 Storage

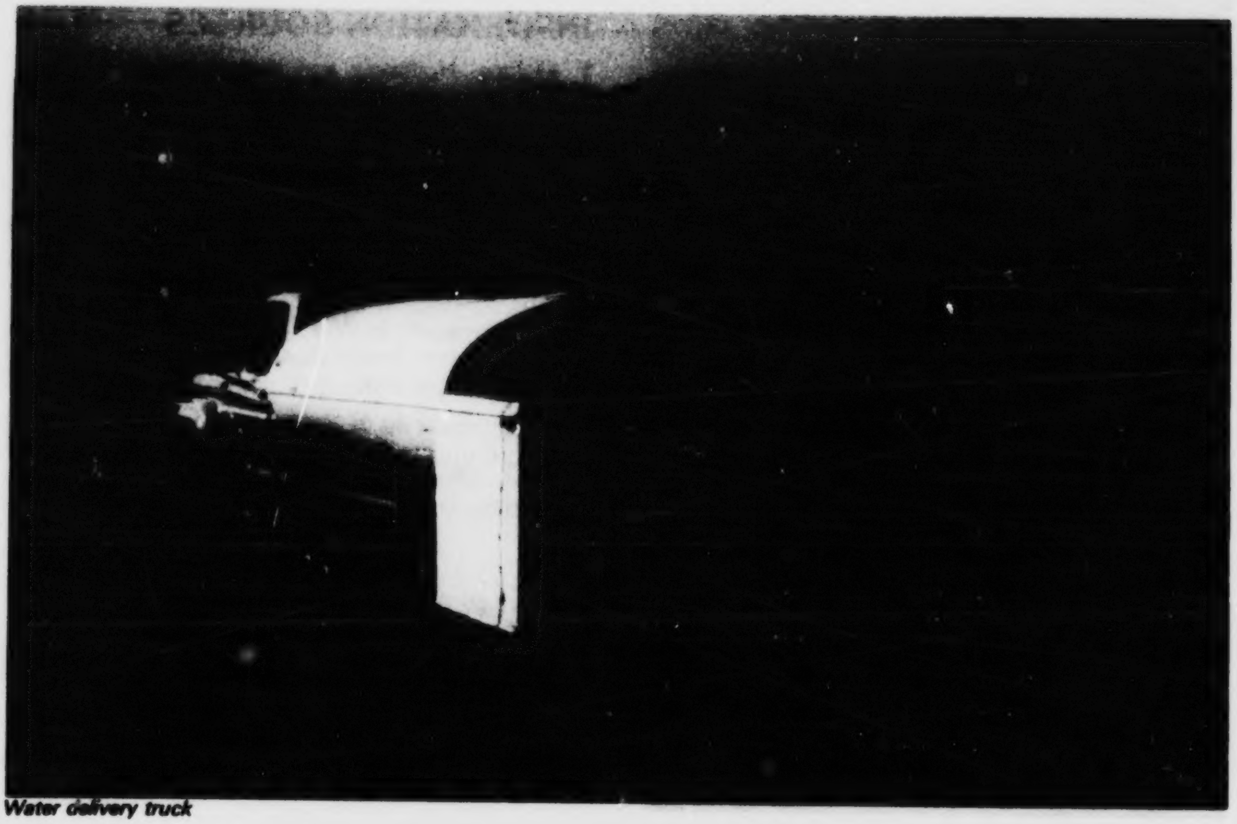
A 90 m³ (20,000 Ig) storage tank will be provided under Stage C for fire storage. This system is designed for a population of 780 with a design consumption of 157 Lpcd (34.5 Igpcd). A fire hydrant will also be located in the terminal building. The design consumption is based on a future distribution system which is to be a combination of piped and truck water delivery.

The storage tank will be located adjacent to the terminal facilities in the settlement.

B.1.6 Terminal Facilities

The terminal facilities which are to be constructed under Stage C of the new water supply system will be located in the settlement (see aerial photo). The major components of the system are as follows;

Water Circulation Pumps (2) (plus one spare provided) - for return line



Water delivery truck

- Capacity: 2.3 L/s @ 90 kPa TDH (30 Igpm @ 30′ TDH)
- Type: In-line centrifugal

Truck Fill Pump (1)
- Capacity: 7.5 L/s @ 90 kPa TDH (100 Igpm @ 30′ TDH)
- Type: In-line centrifugal

Tank Recirculation Pumps (2)
- Capacity: 0.75 L/s @ 60 kPa TDH (9.9 Igpm @ 20′ TDH)
- Type: In-line centrifugal

The building will include boilers and heat exchangers for recirculation with freeze protection of water in both the supply line system and the storage tank. Chlorination facilities will also be provided as described earlier.

B.2 Water Distribution

B.2.1 Trucked System

Water distribution is entirely by trucked delivery and is handled by the Hamlet. At present, it is trucked from Marcil Lake and distributed to holding tanks in each building. A 4560 L (1000 Ig) wheeled truck is used for delivery. In the future, water will be obtained from the terminal facilities and delivered using trucked delivery.

B.3 Sewage Collection

B.3.1 Truck Pick-up

Sewage collection is by bagged sewage pick-up and sewage pumpout. Bags are collected from within each home once daily except Wednesday and Sunday. The Hamlet Council has the contract for sewage and garbage collection. The charge for each family is $5.00 per month for this service at present.

Homes built since 1974 are equipped with 1580 L (350 Igal) sewage holding tanks. A 4550 L (1000 Igal) sewage pumpout truck is operated by the Hamlet.

B.4 Sewage Disposal

Bagged sewage is hauled to a dump site situated approximately 1.5 km southeast of the settlement and 100 m from the beach. Garbage and bagged sewage is burned in the summer and sometimes buried.

Liquid sewage pumpout is also disposed of at the existing dump site.

B.5 Solid Waste

Solid waste is collected and deposited along with the sewage bags at the disposal site southeast of the community as described above.

B.6 Roads

All the buildings in the community are accessible by

roads. They are surfaced with granular materials obtained from nearby borrow areas. The roads have been constructed on the existing soil without any excavation. The material has a tendency to break down under extensive use.

B.7 Surface Drainage

There are no serious drainage problems in Arctic Bay. Development has maintained most of the natural drainage patterns. Culverts are provided to allow for effective drainage through the community.

B.8 Fire Protection

The fire protection system of Arctic Bay is comprised of eight volunteers and a 160 kg (350 lb) dry chemical extinguisher. In the future, a hydrant at the terminal facilities will provide added fire protection capabilities as well as a new fire truck delivered on the 1980 sealift.

B.9 Other Services

Other services include a nursing station with two nurses, a primary school and telephone services. There are radio and television services but no newspaper. Power is supplied by NCPC to the Hamlet with diesel generation facilities.

INFORMATION SOURCES

1. Makale, Holloway and Associates Ltd., *Arctic Bay Development Plan,* December 1976.

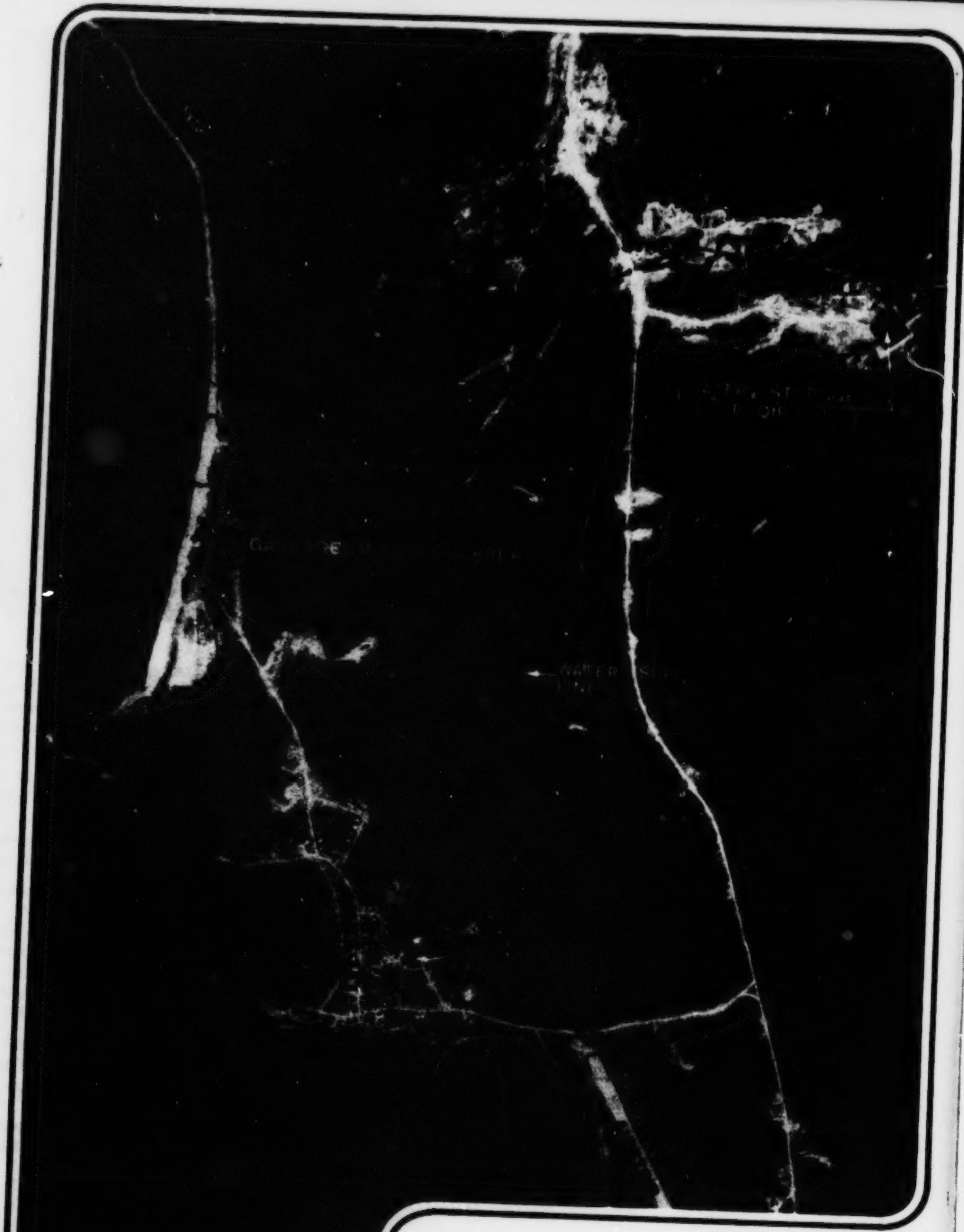
2. F. Morison, *Arctic Bay Water and Sanitation Report,* November, 1978.

3. Health and Welfare Canada, Medical Services, (Jack Grainge), *Report on Water Supplies and Waste Disposal, Arctic Bay, N.W.T.,* November, 1976.

4. Government N.W.T. Department of Public Works, *Project: Water Supply System, Arctic Bay, N.W.T.,* March 1980.

5. Government of N.W.T., Department of Public Works, Contract Documents for *'Arctic Bay Water Supply',* March 1980. (Consultant: M.M. Dillon, Consulting Engineers & Planners).

Broughton Island


WATER SUPPLY LINE

BROUGHTON ISLAND

SCALE - 1: 30,500
N.A.P.L.
NO. A25554-109 1/8/80

A. GENERAL

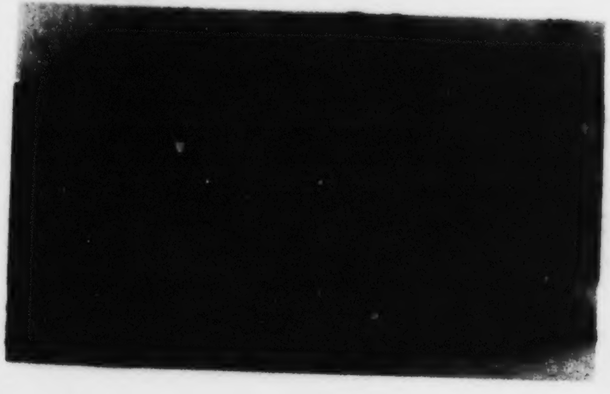
A.1 Location

The community of Broughton Island is located on Broughton Island just off the easterly coast of Baffin Island at latitude 67°33'N longitude 64°02'W. It is approximately 480 air km north of Frobisher Bay.

A.2 History

This community was established in 1956-57 when people came to work on the new DEW line site. Families moved to the island from Pangnirtung, Kivitok and also from Padloping Island when it was closed down in the 1960's. An administrative office was established in 1968 and the Hudson's Bay opened its post in 1960.

Truck fill point



A.3 Community Information

Broughton Island became a Hamlet in August, 1979. Its population has been decreasing slightly over the past three years as follows:

POPULATION	YEAR
329	1978
314	1979
323	1980

The average decrease per year has been in the order of 5%. In spite of an apparent downward trend, the population is expected to be fairly stable over the next few years.

The community is about 95% native with hunting, sealing, fishing and crafts being the main activities. Community services include a nursing station, primary school, Anglican Church, Hudson's Bay store, community centre and some recreation facilities.

A 1060 m (3475') airstrip is located south of the community at elevation 4.6 m (15') ASL.

A.4 Geology and Terrain

The area is characterized by glacial drift, consisting of low sandy hills, moraines and outwash deposits that cover much of the bedrock. Outcrops of bedrock are evident throughout the settlement area. The natural soils in the area are a mixture of fine rock silt mixed with beach sands and gravels.

A.5 Vegetation

The tundra vegetation in the area consists of mosses and lichens growing on humus material.

A.6 Climate

This area experiences long cold winters with mean high and low temperatures of -20.7°C and -27.6°C respectively. Summer mean high and low temperatures are 8.3°C and 2.0°C respectively. The total yearly precipitation averages at 29.7 cm. Winds are generally from the northwest.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Water Source and Storage

The water source for the Hamlet is glacial stream located east of the community (see aerial photo). A 150 mm diameter HDPE pipe, approximately 300 m in length connects the stream to the reservoir for refill by gravity each summer. When this surface and shallow bury line is not in use it is drained and the pipe ends coiled. The reservoir is located approximately 2.5 km east of the community. It was constructed in 1978 to provide for winter storage of water. It is about 90 m x 90 m by 10 m deep and is designed to operate with 1 m freeboard and 1.5 m maximum ice thickness, leaving 7.5 m of water depth for use during the winter. The reservoir capacity under winter design conditions is about 20,000 m³. This will provide approximately 8 months storage for a future design population of 876 and a maximum anticipated consumption rate of 90 Lpcd (20 Igpcd). The present consumption averages about 23 Lpcd (5 Igpcd).

Due to the fine silts in the site construction materials, the reservoir was lined with Dupont 3110 membrane material.

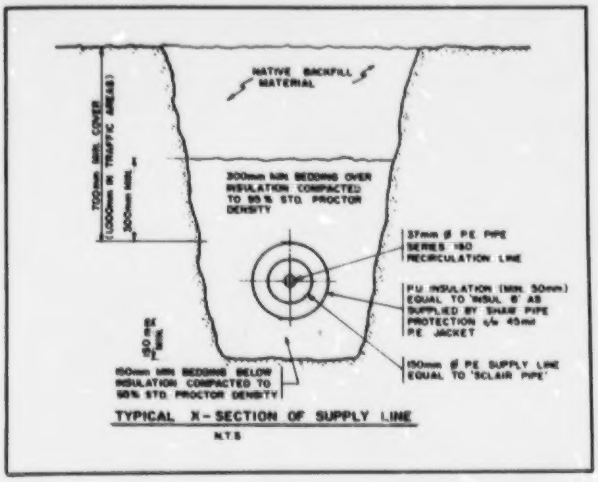
The domestic water source is of acceptable chemical quality as evidenced by the following typical chemical analysis of the river water which supplies the reservoir. The sample was collected October 28, 1980 by J.L. Richards & Associates. (All values in mg/L unless otherwise noted)

Parameter	Value
pH	7.3
Hardness ($CaCO_3$)	12
Alkalinity, Total ($CaCO_3$)	5
Iron (Fe)	1.3
Sulphate (SO_4)	10
Nitrate (NO_3)	<0.1
Fluoride (F)	<0.1
Silica (SiO_2)	1.45
Phosphate	0.02

B.1.2 Intake and Supply Line

A 150 mm diameter HDPE line draws water from the bottom of the reservoir and extends approximately 2460 m to the truck delivery point in the Hamlet. The

Edge of water storage reservoir


NATIVE BACKFILL MATERIAL
700mm MIN. COVER (1000mm IN TRAFFIC AREAS)
300mm MIN.
300mm MIN. BEDDING OVER INSULATION COMPACTED TO 95% STD. PROCTOR DENSITY
37mm Ø P.E. PIPE SERIES 160 RECIRCULATION LINE
P.U. INSULATION (MIN. 50mm) EQUAL TO 'INSUL 8' AS SUPPLIED BY SHAW PIPE PROTECTION c/w 45mil P.E. JACKET
150 MIN.
150mm Ø P.E. SUPPLY LINE EQUAL TO 'SCLAIR PIPE'
150mm MIN. BEDDING BELOW INSULATION COMPACTED TO 95% STD. PROCTOR DENSITY
TYPICAL X-SECTION OF SUPPLY LINE
N.T.S

line is insulated using 50 mm of polyurethane with a 45 mil polyethylene jacket. A 37 mm diameter series 160 HDPE recirculating line is situated inside the water supply line for protection against freezing. Water for recirculation is heated from boilers located in the water distribution point building.

The graded supply line delivers water by gravity from the reservoir to the Hamlet. With a head difference of approximately 56 m, sufficient operating pressure is available at the truck fill point. The shallow bury pipe has a minimum of 700 mm cover with 1000 mm cover in traffic areas.

B.1.3 Water Distribution Point

The truck loading pumps in the station are in-line type pumps with the following characteristics:

Number: 2 (one standby)
Capacity: 7.6 L/s @ 63 kPa TDH (100 Igpm @ 21' TDH)
Motor: 7.5 KW, 3/60/600 volt, 1750 RPM

A heat exchanger is provided and pumping of heated water through the recirculation line is designed to prevent freezing of the supply pipe. Specifications are as follows:

Circulation Pumps

Number: 2 (one standby)
Capacity: 1.2 L/s @ 861 kPa TDH (16 Igpm @ 289' TDH)
Type: Askal Boiler Feed Pump, Model IX
Motor: 2.23 KW, 3/60/600 volt, 750 RPM

Water is chlorinated at the water distribution point using a Wallace and Tiernan A-588 hypochlorinator. Calcium hypochlorite solution is used as the chlorine feed material. The water is also aerated to overcome taste and odour problems in winter and early spring.

B.2 Water Distribution

All domestic water is distributed to users by way of truck delivery. The Hamlet uses a 1978 4550 L (1000 Ig) water truck to deliver water to the residents.
A chlorinator is attached to the loading arm. As water is drawn from the truck it is automatically chlorinated. The school is equipped with four 975 L (215 Ig) fibreglass tanks while most homes are outfitted with 200 L (45 Ig) tanks. Houses constructed from 1977 to present are equipped with 2270 L (500 Ig) water tanks complete with pressure systems.

Water delivery truck

B.3 Sewage Collection

B.3.1 Bagged Sewage

In 1978, 59 residences used the bagged sewage system. The bagged sewage is placed outside each home in half barrels and collected by the Hamlet.

B.3.2 Sewage Pumpout

More than 20 residences plus the school and nursing station now use sewage pumpout tanks.

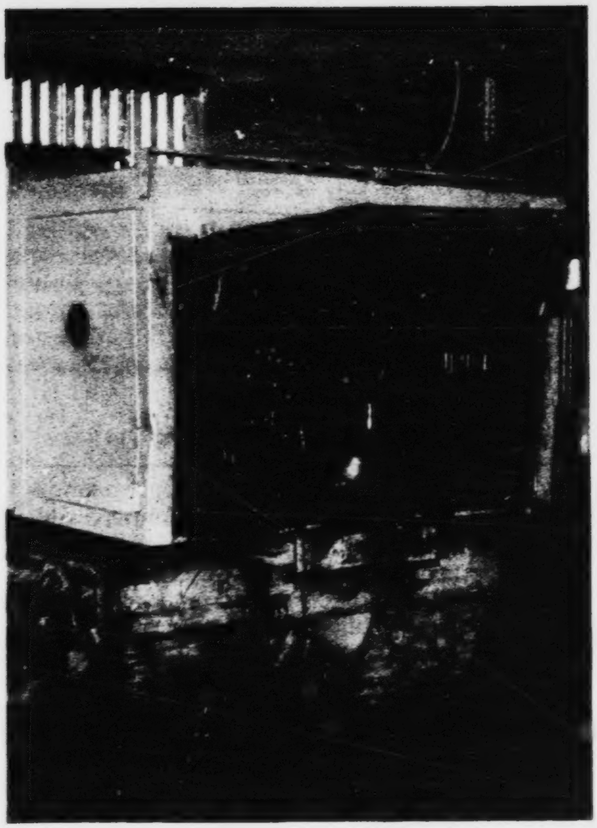
A 4550 L pumpout truck operated by the Hamlet is used for pumpout purposes. An average of 2700 L/day (594 Igal/day) of sewage was generated in 1978 by the users in pumpout facilities.

B.4 Sewage Disposal

Both bagged sewage and liquid sewage pumpout are disposed of at the existing dump site located approximately 1.5 km northeast of the Hamlet. Greywater is currently deposited directly into the ground outside of the residences.

B.5 Solid Wastes

Garbage is collected from empty oil drums in front of the homes and is trucked to the dump site 1.5 km northeast of the Hamlet, and deposited together with the sewage wastes. Bagged sewage, garbage and combustibles are separated to some extent with burning taking place occasionally. The material is compacted and covered with earth materials from time to time.



B.6 Roads and Drainage

The roads are gravel surfaced. A good source of granular material is available nearby for road construction and maintenance. Drainage does not pose serious problems near the shore where gravels are prevalent. Towards the interior of the Hamlet, however, the soil is less impervious and run-off, together with greywater, often collects in puddles, creating nuisance problems.

B.7 Fire Protection

- 10 man volunteer fire department
- alarm boxes on telephone poles
- tracked Muskeg Bombardier with a capacity of 2050 L (450 gal)

B.8 Other

- Power operated by NCPC
- Telephone provided by Bell Canada
- local radio station
- no newspaper or T.V.
- two flights weekly from Frobisher Bay

INFORMATION SOURCES

1. F.J. Williams & Associates, *Investigation and Report on Development and Settlement at Broughton Island, N.W.T.,* December 1965.

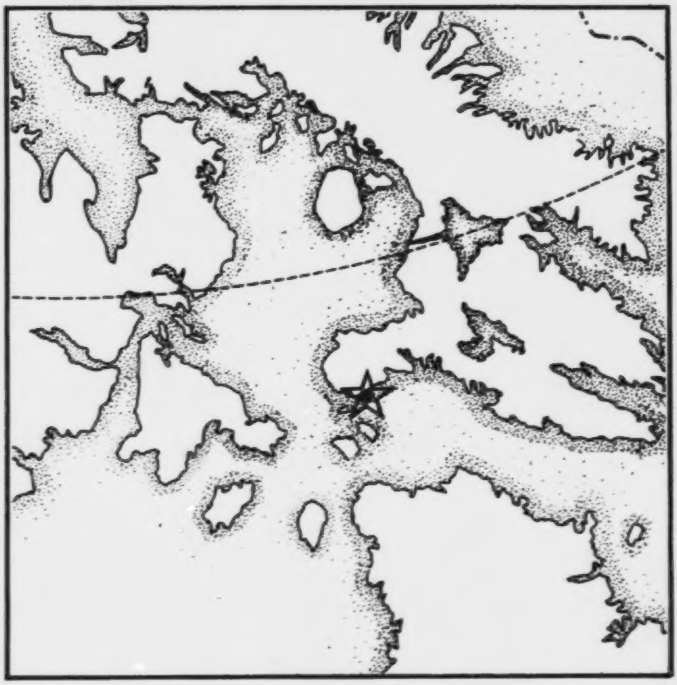
2. Jack Grainge, Regional Engineer, Department of Health and Welfare, *Water Supplies and Wastes Disposal, Broughton Island, N.W.T.,* November, 1976.

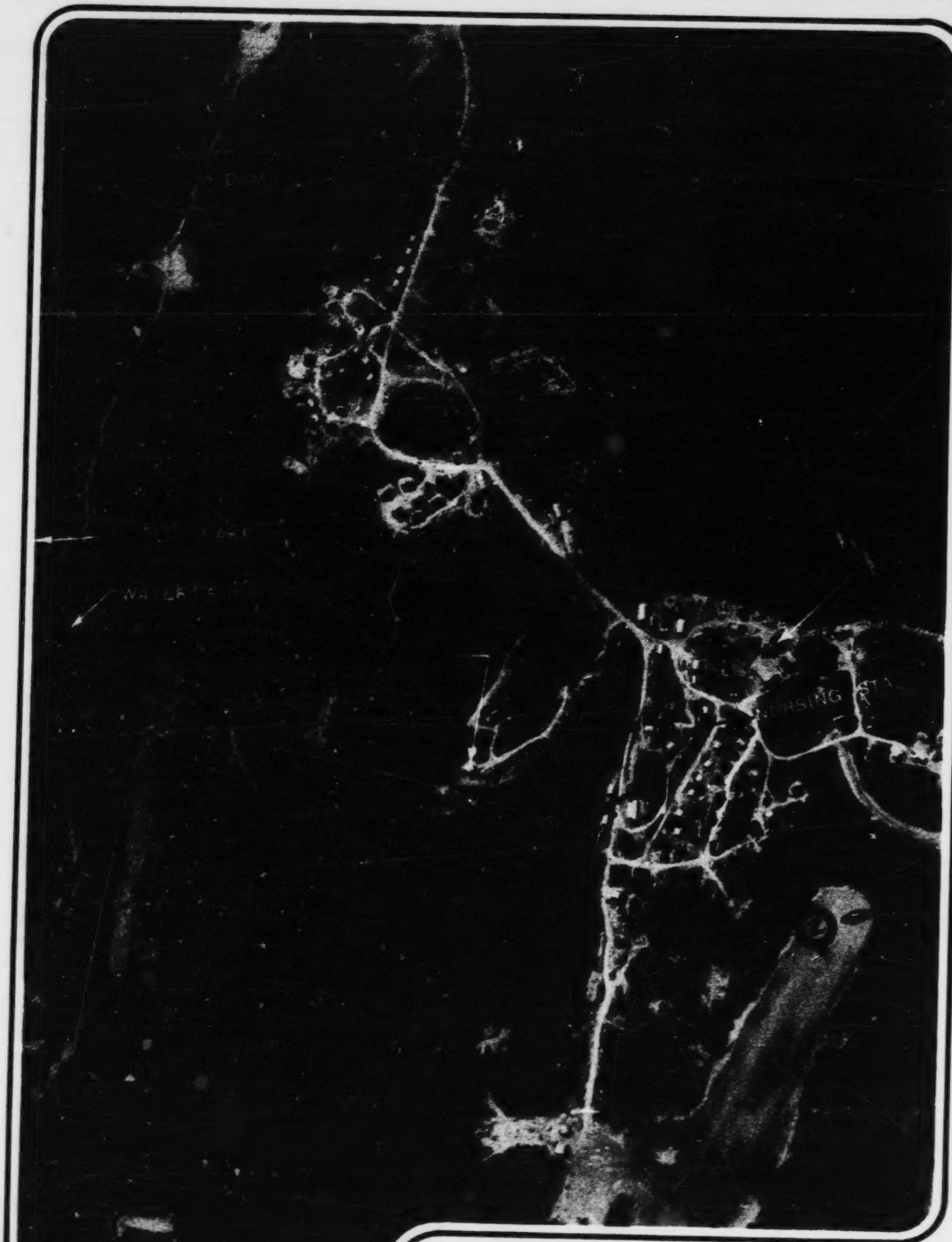
3. Department of Public Works, Government of N.W.T., *Broughton Island Water and Sanitation Report,* March, 1978.

4. W.L. Wardrop & Associates Ltd., *Baffin Region Water Supply Program, Broughton Island,* March, 1972.

5. J.L. Richards & Associates Ltd. *Broughton Island and Pond Inlet -Water Distribution Points - 1979,* Contract Documents.

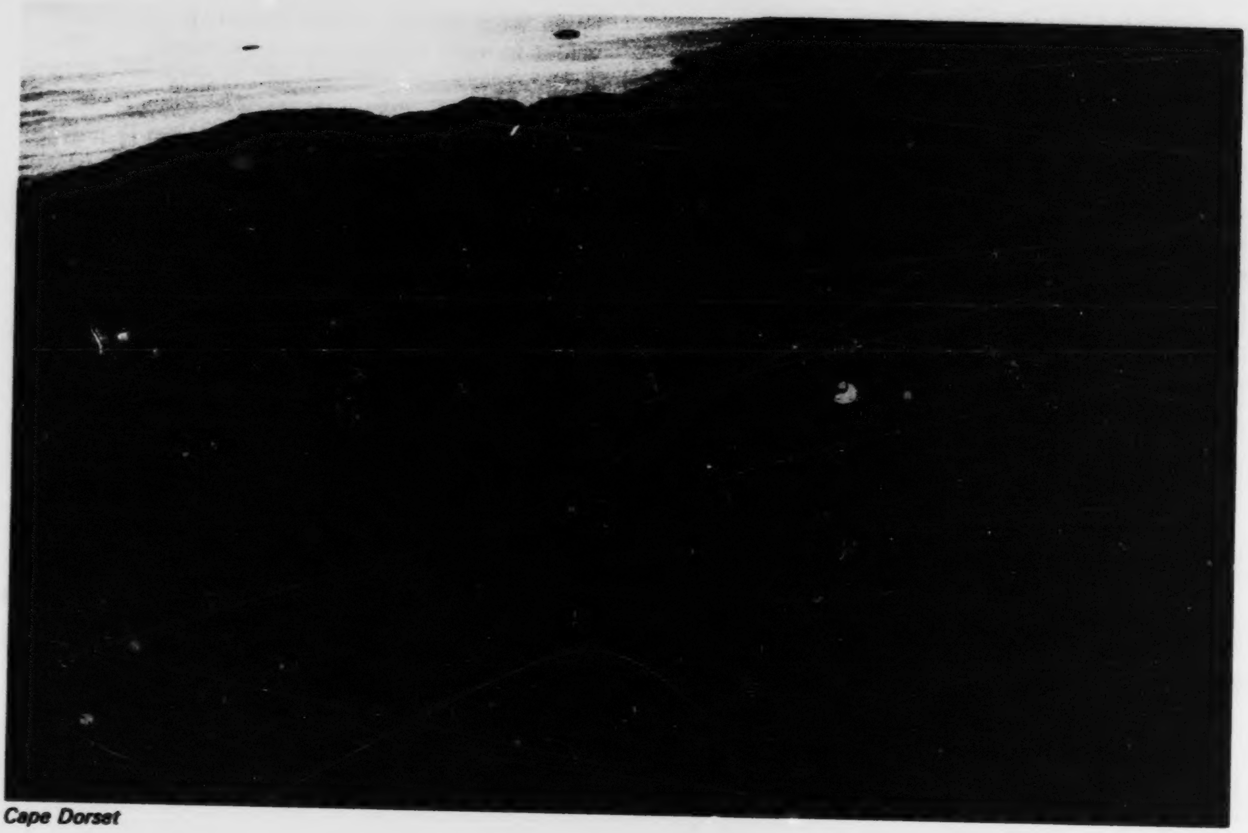
Cape Dorset




WATER
NURSING STA

CAPE DORSET

SCALE - 1:7,500
N.A.P.L.
NO. A25554-70 & 72 31/7/80



Cape Dorset

A. GENERAL

A.1 Location

Cape Dorset is situated at latitude 64°14'N and longitude 76°32'W. It is located on Dorset Island off the southwest coast of Baffin Island, approximately 400 km west of Frobisher Bay.

A.2 History

Cape Dorset was named by Captain Luke Foxe on September 24, 1631 after Edward Sackville, Earl of Dorset. The Hudson Bay Company established a post in 1913. The Roman Catholic Church had a mission in the settlement from 1938-1960. The Anglican Church was built in 1961. The West Baffin Co-op began in 1959 and the R.C.M.P. established a post in 1965.

A.3 Community Information

The community is classified as a settlement. The population figures for the past three years are as follows:

POPULATION	YEAR
693	1978
725	1979
763	1980

The mainstay of the economy is art work such as soapstone carvings and prints. Hunting and fishing also provide employment for the local people, as does the Co-op and the local government.

Services include a nursing station, public school (grades 1 to 9), Anglican Church and a community centre. A 1220 m (4000') gravel landing strip by the community is at an elevation of 48 m (158') ASL.

A.4 Geology and Terrain

Most of the area consists of exposed bedrock. Areas of soil cover are created by the weathering action on the granite bedrock. The soil consists of granular matter ranging from fine sand to gravel and rock fragments. The community occupies two minor coastal valleys. Extensive mud flats are found at the valley mouths.

The permafrost is found at an average of 0.60 to 0.75 m below the surface.

A.5 Vegetation

Cape Dorset is located in a harsh eastern Arctic climate. This area supports various species of tundra vegetation, with lichens being the most predominant.

A.6 Climate

The July high and low temperatures are 7.2°C and 3.3°C respectively, while the January highs and lows are -23.3°C and -28.9°C respectively. The average annual precipitation can be divided into 152 mm of rain and 1178 mm of snow. Winds are generally from west and northwest and average 18 km/h.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Previous to 1972, two methods were used to obtain water. During the summer, water was drawn from a small stream running through the community; from November to June, the settlement utilized ice blocks taken from Airstrip Lake in the fall.

The present system in general consists of intake facilities pumping from Tee Lake to a preheating system located near the lake at a high point above the community. From the heater house, water is discharged and flows by gravity to a water storage tank and truck fill point adjacent to the community (see water supply system flow diagram and aerial photo).

B.1.2 Source

Tee Lake, about 1 km south of the settlement, is used as the domestic water source. The catchment area for Tee Lake is about 90 ha and provides the lake with approximately 227,000 m³ of surface run-off each year.

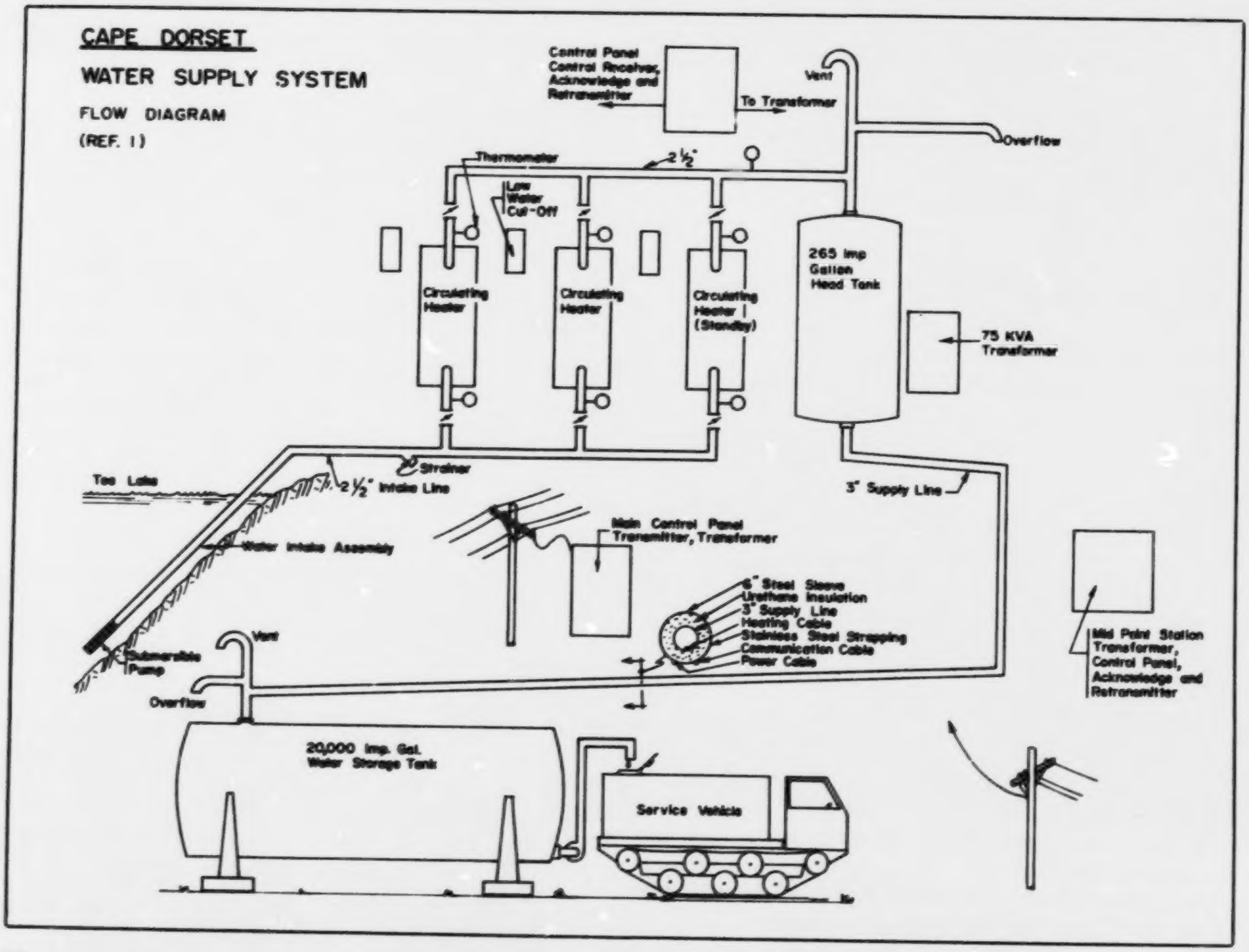
The quality of the water from a chemical standpoint is very soft with a relatively high iron content at times as indicated in the following analysis. (All values in mg/l unless noted otherwise)

Parameter	**Value**
Hardness (as $CaCO_3$)	12
Alkalinity (as $CaCO_3$)	8
Iron (Fe)	0.58
Chloride (Cl)	7.0
pH	7.0
Conductivity	44 umho/cm
Fluoride (F)	<0.1
Sodium (Na)	4.0
Potassium (k)	0.4
Calcium (Ca)	3
Magnesium (Mg)	1.0

(From Department of National Health & Welfare, Frobisher Bay)

B.1.3 System Description

The water intake located at the south end of Tee Lake consists of a submersible pump discharging through 60 m of 64 mm diameter galvanized victaulic coupled Schedule 40 steel pipe. It is insulated with polyurethane and heat traced with Pyrotenax insulated cables strung internally. Pump specifications are as follows:



CAPE DORSET

WATER SUPPLY SYSTEM

FLOW DIAGRAM

(REF. 1)

Control Panel
Control Receiver, Acknowledge and Retransmitter
To Transformer
Vent
Overflow
Thermometer
2½"
Low Water Cut-Off
Circulating Heater
Circulating Heater
Circulating Heater I (Standby)
265 Imp Gallon Head Tank
75 KVA Transformer
Tee Lake
Strainer
2½" Intake Line
3" Supply Line
Water Intake Assembly
Main Control Panel Transmitter, Transformer
6" Steel Sleeve
Urethane Insulation
3" Supply Line
Heating Cable
Stainless Steel Strapping
Communication Cable
Power Cable
Submersible Pump
Vent
Overflow
20,000 Imp. Gal. Water Storage Tank
Service Vehicle
Mid Point Station Transformer, Control Panel, Acknowledge and Retransmitter

Capacity: 6.4 L/s @ 180 kPa TDH (84 Igpm @ 60' TDH)
Motor: 600 volt, 60 Hz, 3-phase

The intake pipeline connects to the heater house located at the high point in the system. The heater house contains circulating heaters and a 1200 L lead tank. The circulation heaters are Chromalox Type NWH-6, 3KW elements.

Water flows by gravity from the head tank at the heater building through a supply line discharging to the storage facilities near the community. The heater house is situated about 124 m higher in elevation than the storage tank. The supply pipe has the following specifications.

Length: 2042 m
Diameter: 75 mm
Material: Galvanized victaulic coupled schedule 40 steel pipe ASTM A53
Insulation: 38 mm polyurethane foam with galvanized sheet steel sleeve
Heating: Internally placed Pyrotenax insulated cables strung in 152 m (500') sections

The heating cable has four major purposes:
(a) to pre-heat the empty pipe prior to pumping (when temperature dictates);
(b) heat the pipe after pumping to facilitate drying;
(c) to thaw the pipes should they freeze full; and
(d) in certain temperatures heat trace is kept on during pumping.

Normal cold weather operation of the supply system is as follows:

- pre-heat supply pipeline prior to pumping;
- shut off heating cable and engage supply pump and water circulation heaters in heater house to heat water during pumping cycle; and
- post heating of pipeline to allow pipe to dry after draining.

For warm weather operation, the preheat period is eliminated.

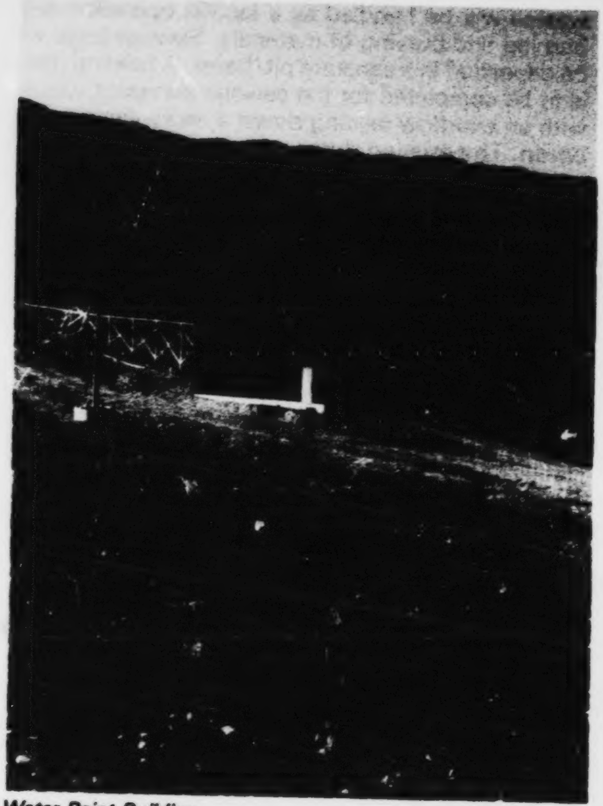
B.1.4 Treatment

At present, treatment consists of the addition of Javex bleach to the water tank truck prior to distribution.

B.2 Water Distribution

Water is distributed by using two 4550 L (1000 Igal) wheeled trucks. The water is drawn form the bottom of the storage tank to the water truck using a truck mounted pump. The contract for distribution is held by the local council.

The school is the largest single consumer. The main section of the school has three storage tanks with a total capacity of 31,675 L (6968 Igal). The original section of the school has a 900 L (200 Igal) storage tank. The average water consumption in the community is approximately 18 Lpcd (4 Igpcd).



Water Point Building

B.3 Sewage Collection

B.3.1 Sewage Pumpout

The sewage collection contract is held by the local council. One pumpout truck with a capacity of 4550 L (1000 Ig) was used for this purpose.

B.3.2 Bagged Sewage

Sewage bags are placed outside homes in 45 gallon barrels and are collected along with the garbage. A pick-up truck is presently used for daily pick-up of wastes.

Wash water is disposed of on the ground outside buildings not equipped with sewage pumpout tanks.

B.4 Sewage Disposal

The sewage disposal area is about 1.0 km west of the community, close to the ocean shore. All sewage wastes are dumped along the brow of an incline. In the spring, a bulldozer consolidates and covers the refuse.

B.5 Solid Waste

Garbage is collected under the same contract as the sewage bags.

A new waste disposal area was being constructed at the time of this writing. It is located in the same general vicinity as the existing one but further east and inland from the ocean. This site will have separate disposal areas for biodegradable solids, sewage bags, and liquid sewage. The biodegradable wastes will be handled as a landfill operation with burning and burying of materials. Sewage bags will be deposited in a separate pit/berm. A holding pond is to be completed for the sewage pumpout wastes with an overflow leading down a rocky slope to the ocean. The existing dump area is to be cleaned and used as an area for bulky non-biodegradable wastes such as vehicles, appliances, etc.

B.6 Roads
All roads are gravel surfaced and maintained in passable condition for wheeled vehicles year round.

B.7 Surface Drainage
Surface drainage is a problem due to the impervious nature of the soils. Wash water that is discarded on the ground around homes tends to collect into puddles as a result.

B.8 Fire Protection
The fire protection in Cape Dorset consists of the following:

- one zone system; call boxes are located throughout the community and are connected directly to a siren; and
- one mini-pumper fire truck which pumps 11-34 L/s (150-450 Igpm).

B.9 Other Services
Telephone - Bell Canada
Local Newspaper - Cape Dorset Newsletter
Radio & T.V. - C.B.C. Northern Service
Power - NCPC - 1200KW diesel generator

INFORMATION SOURCES

1. W.L. Wardrop & Associates Ltd., *Water Supply System Operation and Maintenance Manual,* Cape Dorset, N.W.T., October, 1973.

2. R. James, *Cape Dorset Water Supply Line System Upgrading,* December, 1977.

3. J.L. Richards & Associates Ltd., *General Development Plan,* Cape Dorset, N.W.T., October, 1972.

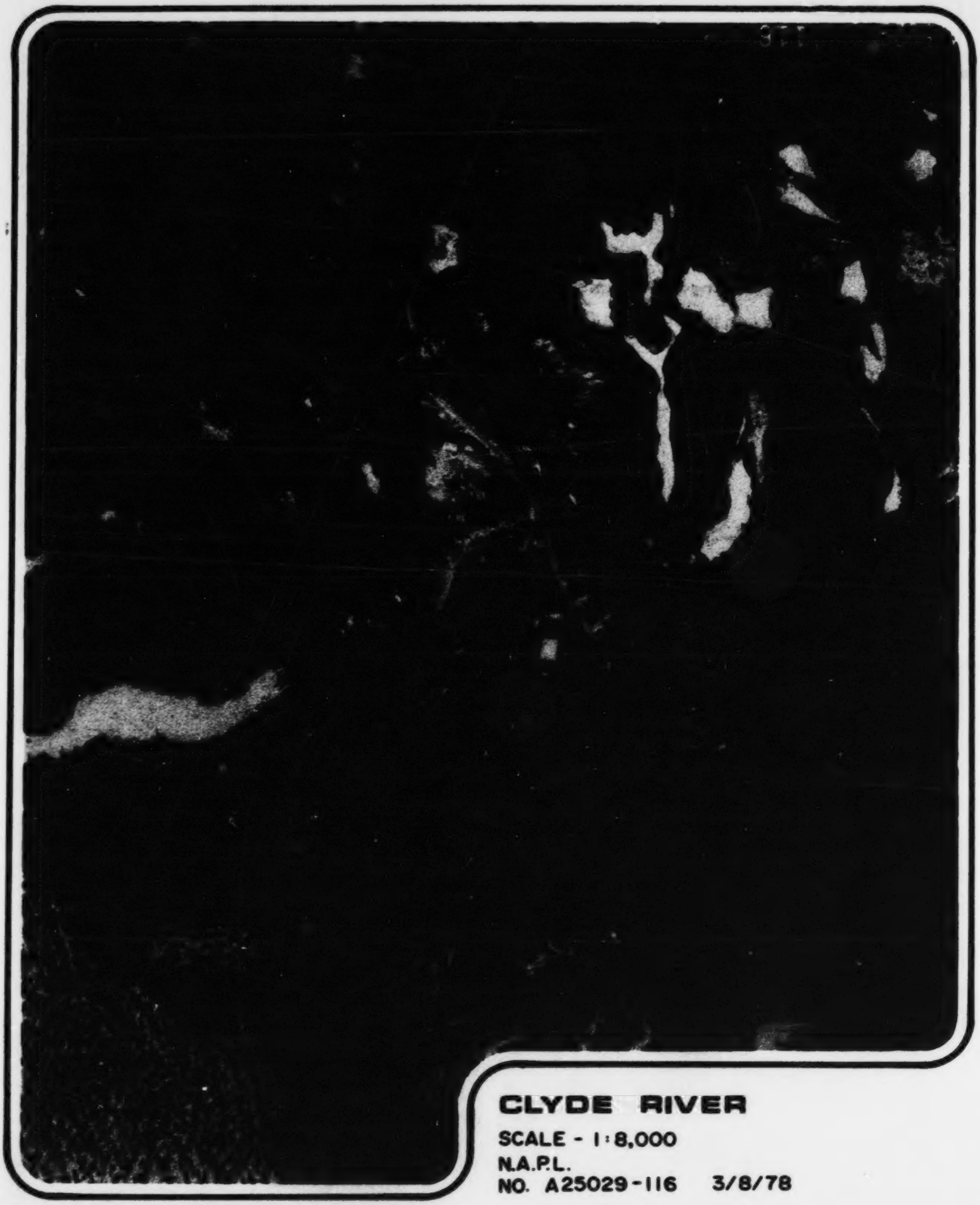
4. W.L. Wardrop & Associates Ltd., *Baffin Region Water Supply Program,* March, 1972.

5. Jack Grainge, *Report on Water Supplies & Waste Disposal, Cape Dorset, N.W.T.,* March, 1977.

6. Neil Bryant, Water Resources D.I.A.N.D., *Review of Municipalities, Settlement of Cape Dorset,* July, 1979.

Water storage building

Clyde River



CLYDE RIVER

SCALE - 1:8,000
N.A.P.L.
NO. A25029-116 3/8/78

Clyde River

A. GENERAL

A.1 Location

Clyde River is located on Patricia Bay on the east Coast of Baffin Island, approximately 740 km north of Frobisher Bay. Its geographical co-ordinates are 70°27'N and 68°33'W.

A.2 History

The original settlement was established in 1922 when the HBC constructed a trading post across the bay. It was moved to its present site during 1967-70. During World War II, Clyde River began to expand with the erection of the weather and navigational aid station. Native peoples constitute about 93% of the total population.

A.3 Community Information

Clyde River achieved Hamlet status on July 1, 1978. Between 1978 and 1980 the population increased from 411 to 443. The economy of the community depends mainly upon trapping and the production of carvings.

The dimensions of the gravel landing strip are 1070 m x 30 m and it is located at an elevation of 61 m ASL. The unlicenced strip is located 3.2 km east of the community.

A.4 Geology and Terrain

Clyde River is situated on a south-facing slope that gradually rises to 152 m ASL. The townsite itself occupies a shallow gravel ridge 3 m to 9 m above high tide and lies 150 m to 300 m from the shore.

The bedrock is precambrian crystalline shield mantled with a thin veneer of glacial till. In earlier geological times, the land was submerged to a 50 to 60 m depth and, as a consequence, there are lacustrine deposits of unconsolidated sands and gravels.

Permafrost is found at a very shallow depth which contributes to some drainage problems.

A.5 Vegetation

The vegetation is typical arctic tundra. With the short summers the most common types of vegetation are mosses and lichens.

A.6 Climate

The July high and low are 8.8°C and 0.8°C. The January mean high and low temperatures are -23.1°C and -30°C respectively. The Hamlet receives an average of 205 mm of precipitation yearly. The rainfall portion is 59 mm and snowfall accounts for 146 mm.

The weather is often clear, but week long periods of fog in the summer and blizzards in the winter are common, often preventing aircraft from landing. The prevailing winds are northwesterly at 10 km/h.

Bagged sewage and garbage pickup

B. MUNICIPAL SERVICES

B.1 Water Supply

The year-round source of potable water is a lake situated about 1 km inland from the settlement, at an elevation of 125 m to 150 m. The lake is fed from a series of lakes and streams further inland.

The water is clear, soft and low in dissolved salts. It is slightly corrosive and has a low chlorine demand.

A chemical analysis for the Clyde River Water Supply Lake is as follows: (All values in mg/L unless noted otherwise)

	DATES OF SAMPLING	
	March 8, 1974	July I, 1976
pH	6.8	7.3
Total Hardness (as $CaCO_3$)	40	15
Alkalinity (as $CaCO_3$)	30	
Total Iron (Fe)	0.04	0.12
Nitrate Nitrogen (N)	<0.1	<0.1
Chloride (Cl)	5	
Fluoride (F)	<0.1	<0.1
Total Dissolved Solids	42	22

A hose placed on the lake bottom is used for drawing water directly into the water delivery truck. A gas engine driven pump (Wisconson pump) contained on the water truck is used for pumping. The water is chlorinated by the addition of Javex directly to the truck tank at the rate of 18 ml/1000L (3 oz./1000 Ig) of water.

B.2 Water Distribution

B.2.1 Trucked System

The water is distributed by the use of an International six-wheel-drive truck mounted with a 4550 L (1000 gal) tank.

The water distribution is contracted by the community.

About 2.22×10^6 L (488 080 Ig) of water were delivered during the 1977-78 fiscal year, which suggests an average consumption of approximately 13.25 Lpcd (3.0 Igpcd).

B.3 Sewage Collection

B.3.1 Sewage Pumpout and Truck Pick-up

Sewage collection services are handled by the Hamlet.

The sewage bag wastes are collected in a variety of ways. In some residences the plastic toilet bags are collected directly from the washrooms or from inside the doorways. In other cases the householders prefer to leave these bags outside in half 205 L oil barrels. They are then hauled to the disposal area in an open box trailer, hauled using a John Deere tractor.

B.4 Sewage Disposal

The disposal site is about 1 km east of the settlement. It is located on one side of a small valley through which a stream occasionally flows.

B.5 Solid Waste

Garbage is stored outside in 205 L (45 Igal) used oil barrels outside homes. It is collected along with the bagged sewage and disposed of at the same location as the sewage.

B.6 Roads

There is a considerable quantity of granular material along the bank of the river which is used for road upgrading and construction as required.

B.7 Surface Drainage

Drainage is generally poor due to the impervious nature of the soils. The discharge of wash water presents a problem since it forms puddles in the summer and ice mounds in winter. This causes some public health concerns.

B.8 Fire Protection

There is no organized fire alarm system in Clyde River. The fire facilities consist of 8 volunteers and a new fire truck.

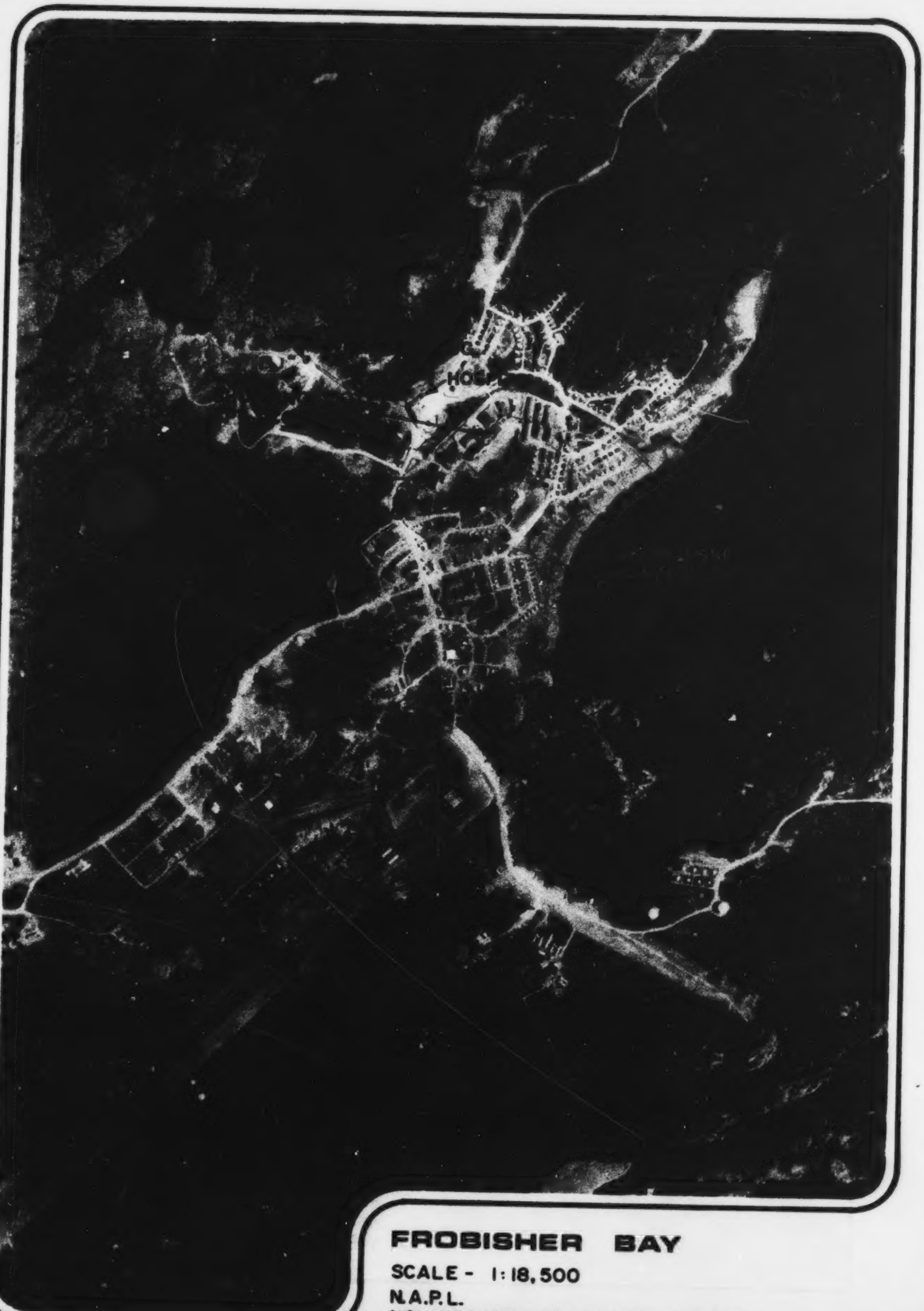
B.9 Other Services

- Telephone - Bell Canada radio telephone
- No newspaper, radio or television
- Contains a nursing station with two nurses
- One RCMP Constable.
- Power is supplied by NCPC and generated by diesel engines

INFORMATION SOURCES

1. Jack Grainge, *Report of Water Supplies and Wastes Disposal, Clyde River, N.W.T.* November, 1976.

Frobisher Bay



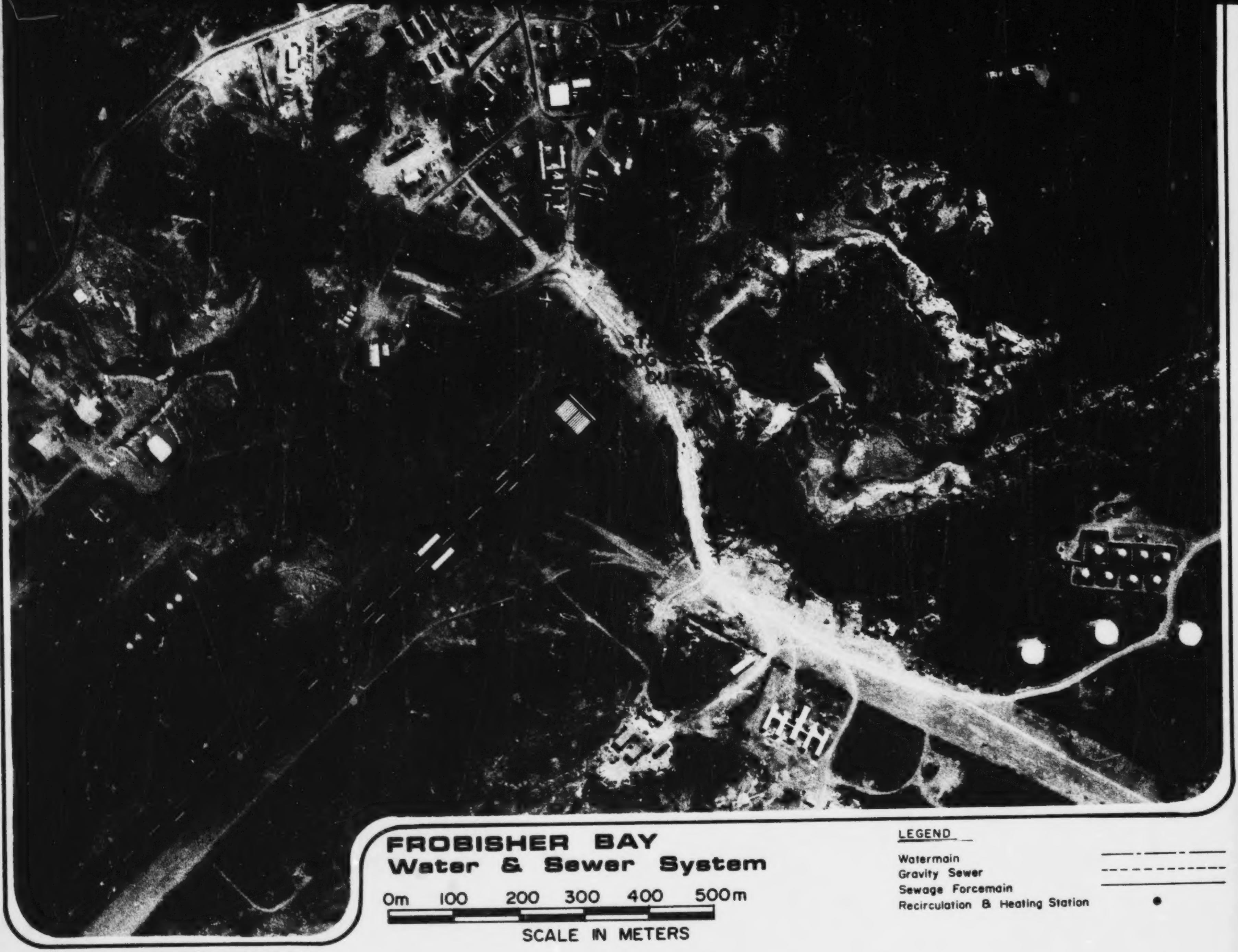
FROBISHER BAY

SCALE - 1:18,500

N.A.P.L.

NO. A24492-137 & 138 19/8/76

SEW
STATION



0m
100
200
300
400
500m
SCALE IN METERS
LEGEND
Watermain
Gravity Sewer
Sewage Forcemain
Recirculation & Heating Station

FROBISHER BAY
Water & Sewer System

NAPL NO. A25553-131, 132, 133, 135, 141, 142, 143 & 145
DATE : 7/80

A. GENERAL

A.1 Location

Frobisher Bay, the largest community in the Baffin Region, is located at the south end of Baffin Island, about 2060 km north of Montreal and 2275 km east of Yellowknife. The geographical co-ordinates are 64°44'N latitude and 68°31'W longitude.

A.2 History

Sir Martin Frobisher sailed into Frobisher Bay in 1576 in search of a Northwest Passage. The present community is near the site of a traditional Inuit fishing camp called Iquluit. A U.S.A. base was established in 1942 and turned over to the Royal Canadian Air Force in 1946-1950, but significant growth did not occur in the area until DEW Line construction commenced in 1955.

A.3 Community Information

Frobisher achieved Town status in 1980. The economy is based on government institutions and services though private facilities are increasing in numbers. Primary, secondary, and adult education are available. Various social institutions, a general hospital, stores, a Legion, a hotel, and crafts centre provide services in a quantity not found anywhere else in the Arctic east of Inuvik. The Town enjoys recreational facilities such as an arena, library, swimming pool, youth centre, and parks.

The Town population in 1980 was 2419 of which approximately 60% are Inuit. The number of people has remained stable over the past few years.

Access is by sea or by air. Freight is shipped from Montreal from July to September. The asphalt airstrip is 2743 m by 61 m at 33.5 m ASL. Frobisher receives five flights weekly from Resolute and Montreal as well as two flights from Yellowknife weekly.

A.4 Geology and Terrain

A rolling terrain surrounds the community. The subsoil is made up of glacial drift over a granitic Precambriam bedrock. The overburden, silty sand, sand, gravel, and boulders, varies from 0 to 18 m thick.

The depth of thaw of the permafrost ranges from 1 m to 1.8 m. The water table is very high and segregated ice lenses may be found

A.5 Vegetation

Vegetal cover is limited on Baffin Island. Lichens, mosses and hardy flowers and grasses flourish in the summer months.

A.6 Climate

Frobisher experiences 8 months of the year in which the average daily temperature is below freezing. The warmest month, July, has an average daily temperature of 7.9°C. January has an average daily temperature of -26.2°C. The mean annual rainfall is 18 cm and the mean annual snowfall is 246.9 cm. The average windspeed is about 15 km per hour.

Frobisher Bay

B. MUNICIPAL SERVICES

B. Water Supply

B.1.1 Source

Lake Geraldine is the source of the Town's water (see aerial photo). It is at an elevation which permits gravity feed to the water treatment plant. The maximum volume of the lake is 2050 million L.

The raw water is clear, soft and low in dissolved minerals. An analysis of the water, partially presented below, was collected on May 27, 1976. (All constituents in mg/L unless otherwise noted)

Constituents	
pH	7.3
Total Hardness (as $CaCO_3$)	27
Alkalinity (as $CaCO_3$)	26
Iron (total)	0.1
Calcium (Ca)	8
Total Dissolved Solids	38

B.1.2 Intake Facilities

The intake is 5.4 m below the crest of a dam at the lake outlet. Water flows to the treatment plant through 213 m of 250 mm diameter steel pipe. Heated water is continously circulated through the intake line to prevent freezing. The incoming raw water is thus maintained at a minimum of 10°C.

Looking towards Koojesse Inlet

B.1.3 Treatment

The water treatment plant was finished in 1963. It was built with provisions for chlorination, flocculation and settling, fluoridation, lime treatment and ozonation. Ozonation, flocculation and settling have been discontinued.

The mixing chamber is 3.81 m x 1.22 m x 5.03 m deep with six over and under baffles. The two rapid sandfilters have a combined area of 9.10 m². The flow rate is approximately 100 L/m²/min. The filters are backwashed at a 1.8 m loss of head or a maximum time lapse of 48 hours.

The plant at full capacity is capable of treating 1.8 million L (400,000 Igal) every 24 hours; currently, however, only daytime operation is necessary to supply the town.

B.1.4 Storage

The storage reservoirs on the first floor of the treatment building have a total combined capacity of 633,950 L (139,450 Igal).

B.1.5 Pumping Facilities

There are two circulation pumps in the treatment building with these specifications:

1. Function: Circulate heated water through intake line
   Model: Bell & Cosset 1BDR
   Motor: CGE Model 111573 1/4 hp, 3 phase/575 v/60 Hz, 1725 rpm
2. Function: same as above
   Model: Armstrong H41546
   Motor: 1/4 hp, 3 phase/575 v/60 Hz, 1725 rpm

The fire pump has the following specifications:

Model: Darling 75771LH
Motor: Tamper 356US-DB5, 3-phase/575V/60 Hz, 1772 rpm

Pressure in the distribution is maintained by the natural head available at water flows by gravity from the treatment plant through the storage facilities. The pressure gradient throughout the Town ranges from 690 to 965 kPa (100 to 140 psi).

B.2 Water Distribution

The original utilidors, built during the eary 1960's, serviced only the hospital, a central complex, the Federal Building, and some residences. Portions of these corrugated metal utilidors remain.

Construction commenced in 1976 on a multi-phase project to expand the piped water and sewage system. Two new buried loops service the east and central portion of town.

A 250 mm ductile iron water main with a 25 mm return encased in an insulated above ground metal box runs between the hospital, high school, and hotel-apartment-shopping complex. A double 50 mm supply and 20 mm return line still serves the G.N.W.T. staff houses.

Circulating utilidor system

Part of one of the new buried looped water mains is 200 mm diameter pipe but generally all recently installed water mains are 150 mm with 37 mm return lines.

In Phases I and II, class 3 insulated ductile iron pipe was installed. Victaulic joints were used in Phase I and Tyton joints were used in Phase II. A 19 mm electrical metallic tubing (EMT) was placed on top of the pipe for the heat trace cable. The pipe and tubing were insulated with 75 mm of polyurethane foam and wrapped in a high density polyethylene jacket.

Series 160 Sclaircor polyethylene pipe was utilized in Phases III and IV of the project. A 25 mm polyethylene thaw tube was installed instead of heat trace. Both pipes are covered with 50 mm of rigid polyethylene foam and a 1.15 mm thick jacket.

A heat trace cable providing 8.2 watts per lineal metre @ 115 V was applied to 50 mm and 100 mm pipe. A cable supplying 16.4 watts per lineal metre @ 115 V was laid on 150 mm, 200 mm and 250 mm pipe. Temperatures are controlled by thermostats in the service manholes.

The Phase I and II water mains and sewer lines are shallow buried and supported on 250 mm x 300 mm timber beams 2400 mm long and spaced at 2.4 m center to center. The ends of the beams are anchored in permafrost and are expected to prevent the pipes from sagging upon local thawing. Phase III and IV piping is supported by granular bedding.

Valves were installed at regular intervals to prevent isolation of relatively small pipe sections in the event of a break or leak. There are facilities to completely drain the system in an emergency.

The manholes used in Phase I and II are precast concrete and contain either or both the sewer and water mains, electrical equipment for heat tracing, and heaters for heating the manholes. Hydrants are at a maximum spacing of 150 m and some are in manholes.

B.2.2 Service Connections

Boxes of 50 mm thick polyurethane 60 cm, covered with 12 mm plywood encase the service connections. Upon hook-up the boxes were filled with polyurethane foam. The Phase I and II copper supply and return water lines are 12 mm or 15 mm in diameter. In Phase III 2-20 mm water lines and a heat trace cable were threaded through a 75 mm polyethylene duct. The domestic circulating pumps are 19 mm Armstrong Model S25 pumps with electric motor, and are designed to run continuously.

B.2.3 Re-circulating Pumphouse

The heating and re-circulating building was built in 1979 between the high school and the hospital. It houses two re-circulating pumps and a hot water converter. Hot water from the N.C.P.C. generating plant heats domestic water in the converter. This water is then injected into the northern loop and unused amounts are re-circulated through the converter. The two Armstrong S-35 pumps have capacities of 1.26 L/s @ 660 kPa.

B.2.4 Trucked System

Approximately one-half of the population is still served by a trucked water system. The community is presently in a period of conversion to a piped system, although Apex will remain on completely trucked system. The municipality contracts the delivery service to private enterprise. At present, five GMC wheeled water tankers are used to handle the community's requirements.

B.3 Sewage Collection

B.3.1 Piped System

The gravity sewer system was expanded during a 5 year period. In the first two construction phases a class 2 ductile iron pipe with cement lining and Tyton joints was laid. A length of 19 mm diameter metallic tubing on top of the pipe contains a heat trace cable. Insulation consists of 75 mm of polyurethane foam covered by a 1.12 mm (HDPE) jacket. The arrangement is supported on the same timber beams as the water main.

For Phases III and IV 100 mm Series 45 Sclaircor HDPE pipe was used. It is not heat traced but is insulated with 50 mm of rigid polyurethane foam and wrapped in a 1.15 mm HDPE jacket. These pipes are simply supported by the granular bedding. The sanitary sewer mains are equipped with a prefabricated clean-out.

B.3.2 Service Connections

Phase I and II sewer service connections are of 100 mm ductile iron heat traced pipe. Phase III and IV connections utilize Series 45 HDPE heat traced pipe in a bundle with the water supply and return lines. The mains and service line connections are enclosed in an insulated plywood box.

B.3.3(a) Sewage Lift Station No. 1

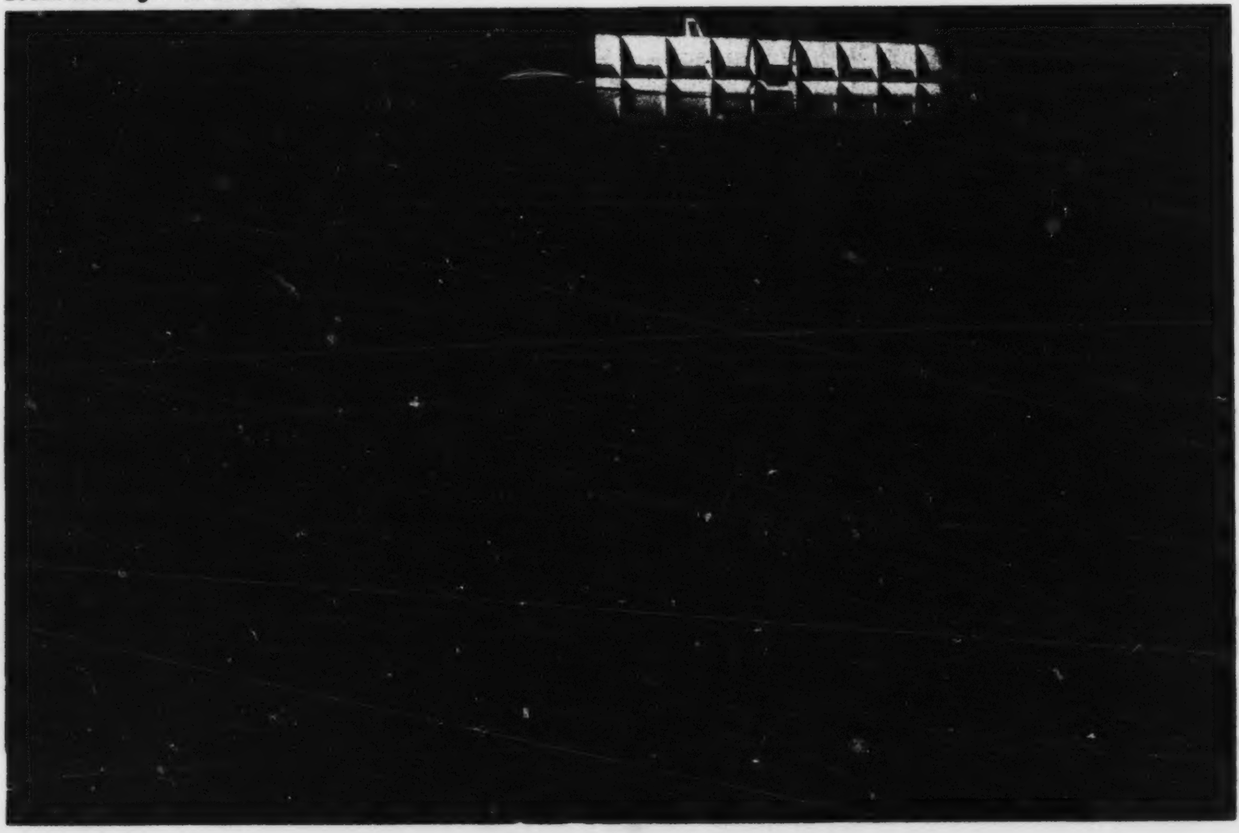
The main (1976) lift station is located at the western end of the gravity collection system. It collects all sewage and discharges it through a 200 mm forcemain towards a macerator building.

The pumphouse contains a wet well and two sewage pumps with the following specifications.

Type:	self-priming centrifugal
Model:	Gorman Rupp Company Model T6A3-B
Capacity:	44.2 L/s @ 174 kPa (580 Igpm @ 58' TDH)
Motor:	Crompton Parkinson 25 HP, 1800 rpm, 3/60/575

There is no standby power supply or pump in case of pump failure. The wet well is equipped with an

Locals assisting in construction



emergency overflow which discharges to the ocean through a 250 mm pipe.

B.3.3(b) Sewage Lift Station No. 2

The second lift station, finished in 1977, collects sewage from the southern section of the town. Waste is pumped through a 150 mm forcemain to a manhole and flows from there to Lift Station *#1* by gravity.

The station is composed of a wet well and an underground pump room with these two pumps:

Type:	Self-priming centrifugal pumps
Model:	Gorman Rupp T-3A3-B
Capacity:	13.9 L/s @ 114 kPa (185 Igpm @ 38' TDH)
Motor:	Leroy Somer 7.5 HP, 3/60/575 v, 1750 rpm

There is no standby power supply for this station. It is equipped with a 200 mm overflow pipe which allows sewage from the wet well to flow into the sea in the event of a lift station failure.

B.3.4 Macerator and Outfall

The macerator and outfall were built to replace 5 outfalls along the shore of Frobisher Bay. It was discovered the macerator will not process bagged waste. As there are insufficient solids in the piped sewage to necessitate maceration, currently all sewage flows from the 300 mm inflow pipe through a bypass and outfall to a sewage holding pond on the seashore.

The macerator unit (Chittenden-Howard Type F5019) and hopper are contained inside a buried concrete unit. Trucked sewage is dumped into the sewage main upstream. The macerator was intended to accept bagged sewage, but vortexing problems have occurred in the hopper using bags. The future of the macerator is currently under review.

The retention pond has the capacity to store one winter's production of sewage. After thawing, waste is released over land to the sea.

B.3.5 Sewage Pumpout and Truck Pick-up

Bagged sewage is collected from about 206 units at least 3 times weekly. The annual number of bags collected was estimated at 60,000 for 1979 (Ref. No. 4).

B.4 Bagged Sewage Disposal

Bagged waste is dumped at the landfill site about 3 km northwest of the Town beside the domestic garbage in the west. It is collected under private contract using a Ford F-100 pick-up truck at present.

Three sewer tankers are used for sewage pumpout under contract from the Town (2 GMC and 1 IHC). The liquid sewage is disposed of at the sewage dumping station located near outfall line to the sewage holding area.

B.5 Solid Waste Collection and Disposal

Solid waste was hauled by compactor trucks and open trucks to the dump until the winter of 1979. This waste combined with bagged sewage was hauled to a site beside Apex, a collection of homes south of the Town. Use was undesirable due to the proximity to homes. A new site on rocky ground in the West 40 has been chosen. The garbage thus cannot be covered with soil but may be burned periodically.

B.6 Roads and Surface Drainage

The base of the roads is composed of gravel, which is in abundant supply. A dust problem was partially alleviated in recent years by paving of the main roads.

B.7 Fire Protection

The Town owns two triple combination pumpers and two tank trucks. These are stored at strategic points throughout the populated area. A volunteer force of 33 is summoned by the fire alarm.

B.8 Other Services

Frobisher Bay has a weekly newspaper, a radio station, telephone and telex service, television, and mail delivery five times per week. A bank, taxi service, and hotel are added conveniences. NCPC operates the power generating facilities which have a combined capacity of 11,300 KW.

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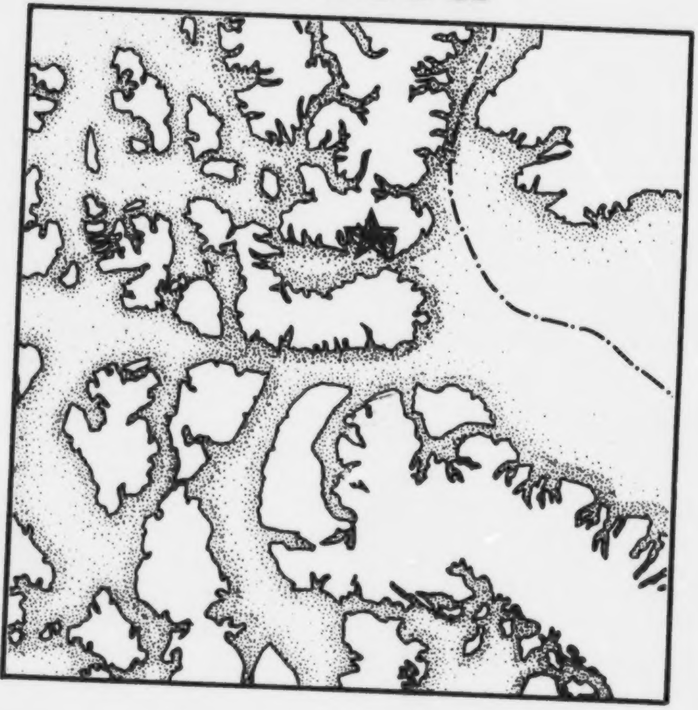
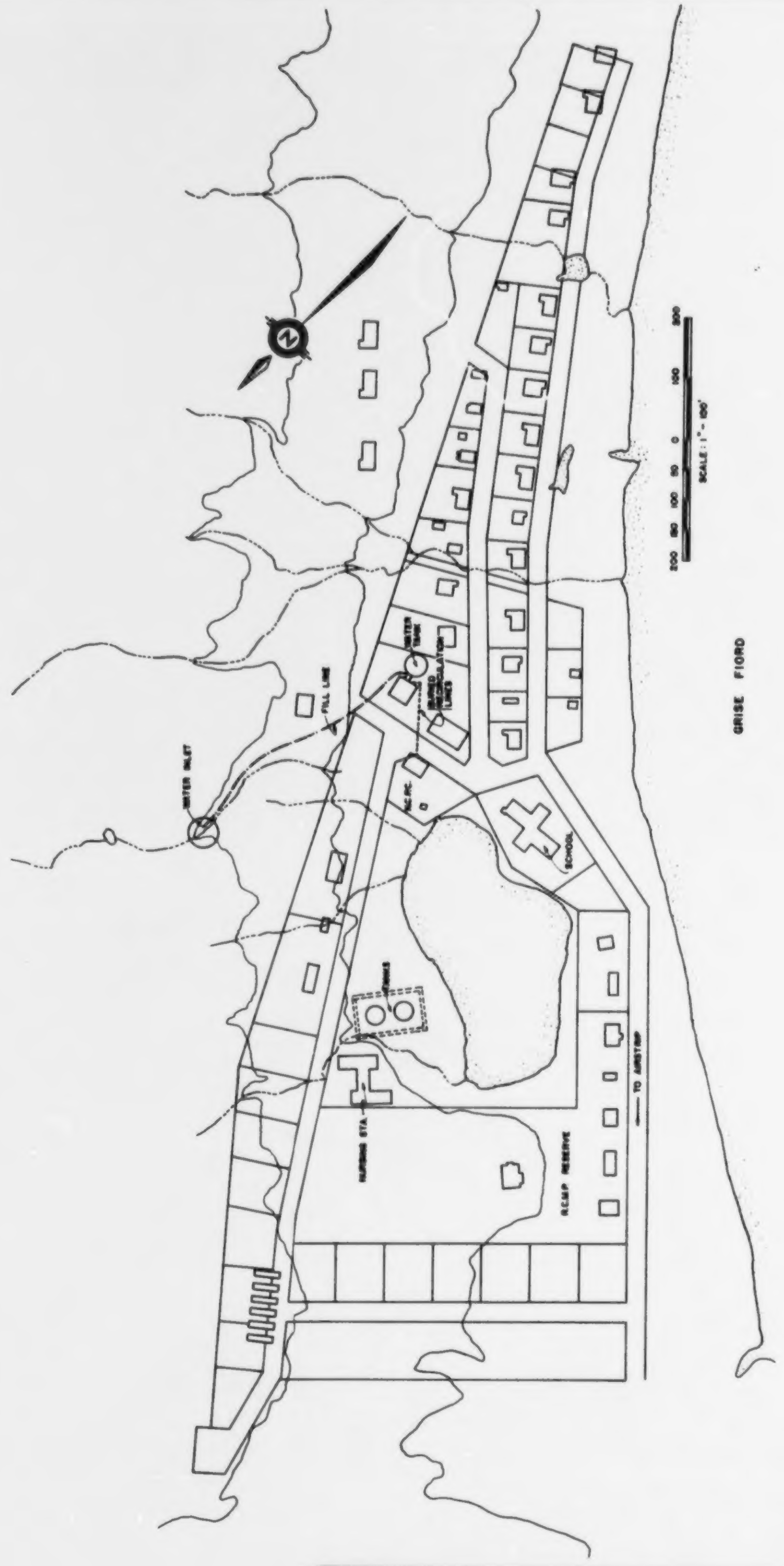
Grise Fiord




N
WATER INLET
FILL LINE
WATER TANK
BURIED RECIRCULATION LINES
H.C.P.C.
SCHOOL
TANKS
NURSING STA.
R.C.M.P. RESERVE
TO AIRSTRIP
GRISE FIORD
200 150 100 50 0 100 200
SCALE: 1" = 100'

GRISE FIORD

SCALE -

N.A.P.L.
NO.

Aerial view

A. GENERAL

A.1 Location

Grise Fiord is located at a latitude of 76°25'N and a longitude of 83°01'W on the southern coast of Ellesmere Island. It is approximately 380 km northeast of Resolute and 1920 air km northeast of Yellowknife.

A.2 History

Grise Fiord was established when the R.C.M.P. and the Eskimos relocated there in the early 1960's from Craig Harbour, 50 km to the east. There are Thule ruins close to the settlement and evidence of the explorers of the late 1800's and early 1900's can be found. This is Canada's most northerly Inuit community.

A.3 Community Information

Grise Fiord, which means 'Pig Fiord' in Norwegian, is classified as a settlement. Between the years 1978 and 1980 the population varied only from 99 to 88. The population is expected to be fairly stable at around 100 people.

The economy of Grise Fiord is primarily based on hunting, trapping, fishing and some handicrafts. Services include a nursing station, primary school (grades K - 8), and two R.C.M.P. constables.

The settlement has a 610 m x 24 m gravel airstrip at an elevation of 38 m ASL.

A.4 Geology and Terrain

The settlement is situated on a narrow strip of beach near the mouth of Grise Fiord. From the beach the land slopes back in a series of low benches for a few hundred feet to the face of a steep rock face. The surficial soils in the area consist of free draining gravel deposits. A major layer of silty sand with traces of gravel was identified over a large portion of the valley above the settlement. The depth of the permafrost table is about 0.6 m.

A.5 Vegetation

Grise Fiord is located in the Arctic Tundra. The vegetation consists of mosses and lichen.

A.6 Climate

The temperature in Grise Fiord ranges from a mean high and low in July of 10°C and 2.2°C to a high and low of -27.2°C and -35°C in January. Precipitation consists of 152.4 mm of snow and a trace of rain. The prevailing winds are southeast at 18 km/h.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Before the existing water supply came into use the community used a glacial stream flowing from the nearby hills as a summer source. A half round section of corrugated culvert pipe was placed in the stream bed to form a makeshift dam.

During the winter, ice was hauled from icebergs in the sea. It was delivered to homes and melted in water holding tanks. This method involved a large amount of handling and resulted in a high potential for contamination.

A Raypack reverse osmosis machine for the desalinization of sea water was experimentally tried in Grise Fiord. The experiment was not very successful. The process proved to be complicated, expensive and unreliable.

B.1.2 Source

The present source of the settlement's water supply is a glacial stream that flows from the hills behind the community during the summer months. The water is clear, soft, contains negligible amounts of dissolved salts, and is slightly high in iron content.

Following is a typical chemical analysis of the water. (All values in mg/l unless otherwise noted)

Parameter	**Value**
Hardness (as $CaCO_3$)	12
Alkalinity (as $CaCO_3$)	11
Iron (Fe)	0.74
Chloride (Cl)	2.0
pH	7.1
Fluoride (Fl)	<0.1
Sodium (Na)	9.0
Potassium (k)	0.7
Calcium (Ca)	3
Magnesium (Mg)	1.0
Phosphorus (PO_4)	0.08

(Sampled by Department of National Health & Welfare, April 5, 1979)

B.1.3 Intake Facilities

In the summer water is pumped from the glacial stream. A half round section of corrugated metal pipe is placed in the stream bed to form a makeshift dam. A tank to store the winter's water supply is filled by a hose running from the dam to the top of the tank. The head difference is 3.5 m, allowing flow by gravity.

In the summer the water truck is also filled directly from the stream. A 1.1 L/s (15 Igpm) gas driven pump is used to fill the haulage tank.

B.1.4 Treatment

The only treatment required is chlorination at this time. It consists of a Wallace and Teirnan 94 series Hypochlorinator system.

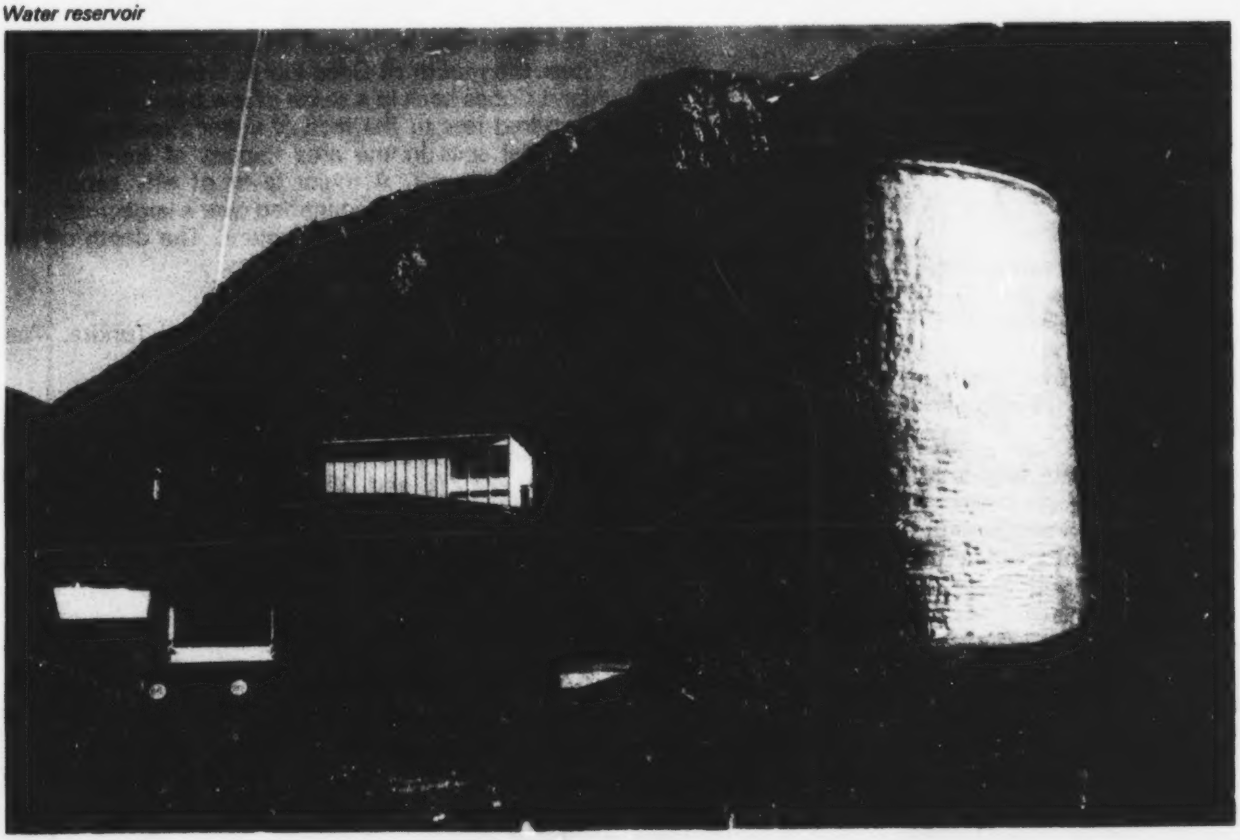
The chlorinator is located in the walkway between the storage tank and the truck garage.

B.1.5 Storage

The storage tank in Grise Fiord was designed to provide the community with water through the winter season (approximately 9-1/2 months storage). The tank's specifications are as follows:

Capacity: 1.4×10^6L (310,000 Ig)

Water reservoir



Bagged sewage and garbage pickup

Diameter:	13 m
Height:	11 m
Material:	welded steel plate API standard 650
Insulation:	64 mm urethane foam max.

B.1.6 Pumping Facilities

Three identical pumps are used. Two are used for cold water circulation and one is for hot water circulation for protection against freezing. Pump specifications are as follows:

Type and Model:	PACO, Model 1570-5 vertical in-line, single stage, cast iron body, bronze fitted, centrifugal pump.
Capacity:	3 L/s @ 60 kPa (40 Igpm @ TDH 20')
Motor:	1/2 H.P., 1750 rpm, 115 V/1/60 Hz, drip proof

B.2 Water Distribution

B.2.1 Trucked System

The settlement of Grise Fiord uses a trucked system to distribute water in the community.

Water delivery is contracted to the settlement council.

A wheeled truck with a capacity of 4550 L is filled inside the garage located beside the storage tank. Deliveries are made five days a week. A Gorman-Rupp centrifugal pump is mounted on the vehicle and is used to fill the 227 L (50 Ig) tanks in the residences.

B.3 Sewage Collection

All of the sewage in Grise Fiord is collected by means of bagged sewage pick-up.

Sewage pick-up is handled by the local council. The bags are placed in 205 L (45 Igal) drums outside homes for removal three times a week. They are hauled using a wheeled garbage trailer pulled by a tractor.

B.4 Sewage Disposal

Bagged sewage is discarded over the edge of a 2 m high embankment in a small area approximately 1.5 km east of the settlement. Wash water from the nursing station is discharged into a nearby pond. Wash water from the school is contained in a holding tank and is occasionally drained. It flows across the road to the sea. Residents discharge their wash water on the ground beside their homes.

B.5 Solid Waste

Solid wastes are collected along with and under the same contract as bagged sewage. Refuse is burned outside homes in 205 L (45 Ig) drums and disposed of in the same place as the bagged sewage.

B.6 Roads

The roads in Grise Fiord are subject to use only by a few trucks and tracked vehicles. There is an ample supply of suitable gravel in Grise Fiord. Annual road construction and upgrading is carried out.

B.7 Surface Drainage

Since the community is situated on a gravel beach, there are no serious drainage problems.

B.8 Fire Protection

Fire protection in Grise Fiord consists of eight volunteers and a 159 kg (350 lb) dry chemical extinguisher. This is the minimum for northern communities.

B.9 Other Services

Bell Canada provides radio-telephone service via the Anik satellite. Mail service is bi-monthly. There is no radio, T.V. or newspaper in the community. NCPC provides for the power requirements using 3 diesel generators.

INFORMATION SOURCES

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3. Elmer W. Brooker & Associates Ltd., *Geotechnical Evaluation, Water Supply Study, Grise Fiord,* December, 1971.

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Hall Beach

TO GARBAGE DISPOSAL AREA
TONE

HALL BEACH

SCALE - 1:7,500
N.A.P.L
NO. A25029-96 7/78

Aerial view of Hall Beach

A. GENERAL

A.1 Location

Hall Beach is located at a latitude of 68°46'N and longitude of 81°12'W in Melville Peninsula. It is 840 km northwest of Frobisher Bay in the Foxe Basin area.

A.2 History

Hall Lake was named after Captain C.F. Hall, an American explorer who spent a number of years on Melville Peninsula in the middle of the last century. The Hall Beach area has been inhabited at various times from the 13th century on.

The present-day site was established in 1953 as a result of the building of a large DEW line site. The community has grown considerably because of immigration from the outcamps.

A.3 Community Information

Hall Beach achieved Hamlet status on April 1, 1978. From 1978 to 1980 the population increased from 396 to 400, a minimal change.

The economy of Hall Beach is based on employment with the DEW Line, and fur trapping. Services include a school, Roman Catholic Church, and community centre. A 1524 m x 46 m gravel strip at an elevation of 8 m is located 3.2 km south of the Hamlet.

A.4 Geology and Terrain

The Townsite stretches approximately 1100 m along the 120 m wide stretch of sand and gravel raised beaches.

A.5 Vegetation

Typical Arctic vegetation such as lichens and mosses are predominant.

A.6 Climate

The July high and low temperatures are 8.5°C and 2.3°C. The January high and low are -27.6°C and -35.7°C. Rainfall of 76.5 mm and snowfall of 1160.8 mm combine to form a total precipitation of 106 mm. The prevailing winds are northwesterly at 21 km/h.

Water supply

B. MUNICIPAL SERVICES

B.1 Water Supply

The present source of water for the Hamlet and Fox Main Dew Line Station is the Dew Line reservoir. It was built in 1956, 1.6 km west of the station and is fed by a diversion from a dam. The approximate capacity is 91,000 m³. The water in the reservoir and lakes raises during spring run-off. When it is at its maximum, the surrounding dam is shut and this storage is used to supply the users. The water is found to be generally satisfactory for potable use. Partial results of analyses of two samples taken in November, 1979 are given below. (All units in mg/L unless otherwise noted)

Constituents	**Sample**
pH	8.2
Alkalinity ($CaCO_3$)	92-93
Hardness ($CaCO_3$)	145-113
Colour	2.5-1.2
Iron (Fe)	0.6
Turbidity	1.8-2.7 JTU
Total Dissolved Solids	162-165
Suspended Solids	1.0-0.5
Calcium (Ca)	36
Sodium (Na)	10-11

(Oliver, Mangione, McCalla & Associates Ltd., September, 1980)

There is no permanent intake structure. Water is withdrawn by dipping the truck hose into the lake. In the summer, water is taken from the shore, while during the winter a hole is cut in the ice and water is drawn with a hose. The water is treated by the addition of chlorine to the water truck tank. There are no storage or pumping facilities in the community.

B.2 Water Distribution

Water is distributed by a 4500 L 1979 truck at this time. A standby 4500 L tank on a 1972 vehicle is also available.

Water is delivered five days a week. The operator usually makes about ten deliveries per day. Storage tanks in the few homes with pressure water systems have 1100 L tanks. There are 225 L containers for storage in 42 of the older homes.

B.3 Sewage Collection

The nursing station, transient centre and school have sewage holding tanks. They are pumped out with a 4500 L sewage truck. The rest of the community's waste is collected in the form of bagged sewage. These are collected from outside the home daily by the garbage truck. The truck has a special tank which permits separation of the bagged waste from the garbage.

B.4 Sewage Disposal

The disposal area is located about 3 km north of the Hamlet on the shoreline. Sewage is dumped a bit further north than the dryer garbage in a region of good gravel and is covered on a seasonal basis.

B.5 Solid Waste

Garbage is collected along with the bagged sewage and is deposited at the dump located about 3 km north of the Hamlet. The garbage is regularly burned and buried.

B.6 Roads & Surface Drainage

The roads receive little usage except for service vehicles and are generally satisfactory. Drainage is positive due to granular nature of soils in Hall Beach.

B.8 Fire Protection

Fire protection in Hall Beach consists of the following: - 8 man volunteer fire brigade - 160 kg dry chemical fire extinguisher

B.9 Other Services

- Other services include twice weekly mail delivery.
-NCPC provides power with diesel generator facilities.

INFORMATION SOURCES

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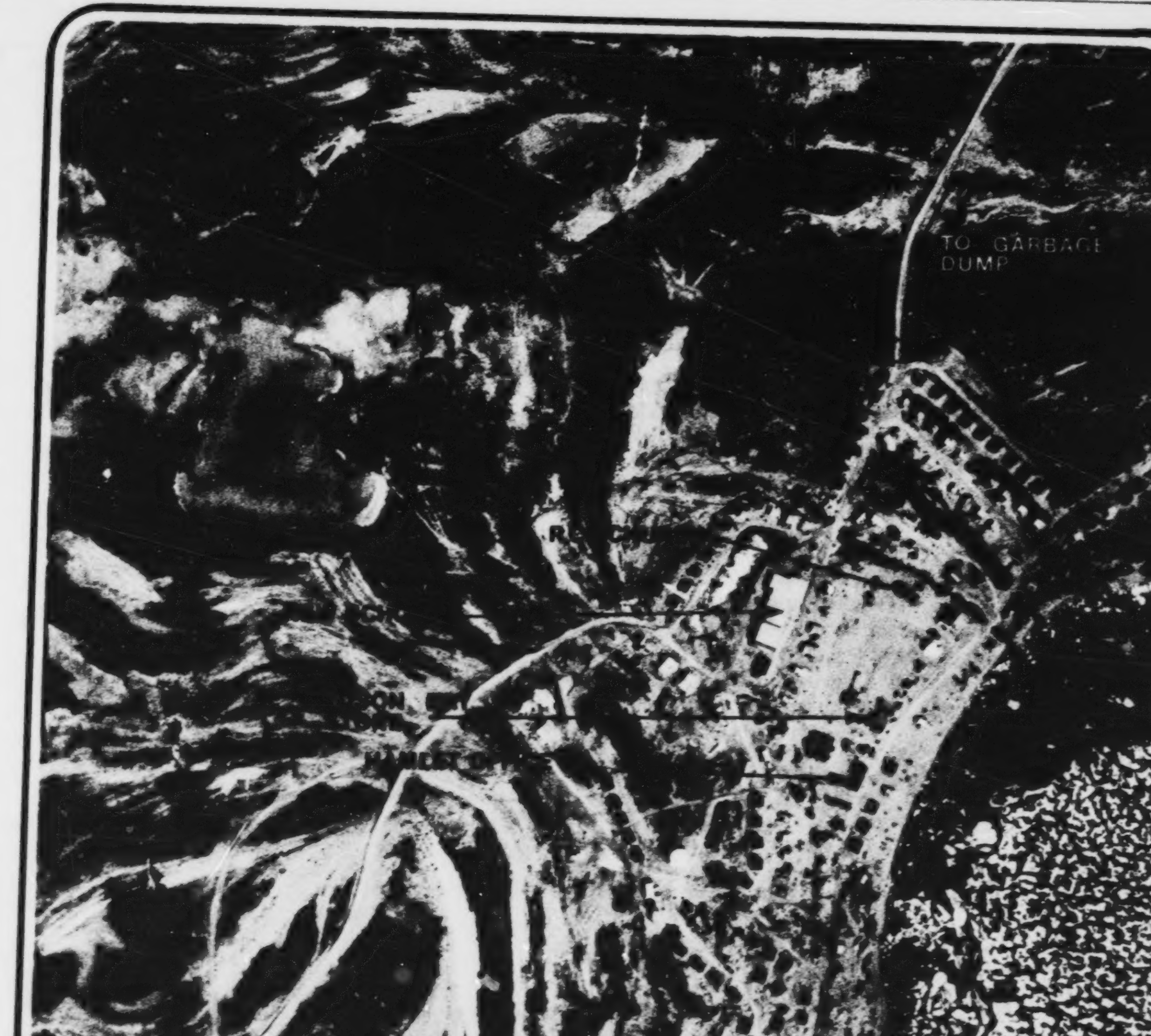
Igloolik


TO GARBAGE DUMP
HAMLET OFFICE
TURTON BAY

IGLOOLIK

SCALE - 1: 7,500
N.A.P.L.
NO. A25029-123 3/8/78

DIAND research laboratory

A. GENERAL

A.1 Location

Igloolik is situated on Igloolik Island at 69°22′N latitude and 81°46′W longitude. The island is located in the Foxe Basin Lowlands, is bounded in the north by the Fury and Hecla Strait and is separated from the mainland (Melville Peninsula) to the south by Hooper Inlet.

Igloolik is approximately 360 km northeast of Repulse Bay and 1632 km northeast of Yellowknife.

A.2 History

In 1823 Captain W.E. Parry spent the winter at Igloolik. During the second half of the 19th century, whalers occasionally penetrated into Foxe Basin. In 1937 the Roman Catholic Mission was established. The Hudson's Bay Trading Post followed in 1939. During the 1940's trapping became a major economic activity. By 1959, the addition of a school and new government building led to Igloolik emerging as a settlement of major status in the Baffin region.

A.3 Community Information

Igloolik achieved Hamlet status on July 1, 1976. Between 1978 and 1980 the population increased from 753 to 789. The economy of the community is based on employment with the Co-op, HBC, government and hunting. A 1067 m sand runway at an elevation of 51 m ASL is located southwest of the community.

A.4 Geology and Terrain

The island of Igloolik is located in the Foxe Basin region. The glaciers retreated from this region about 5000 years ago.

The island is composed of dolomitic conglomerate with sandstones, dolostone and siltstone occasionally interspersed throughout. The most predominant features on the island are the east and west ridges.

Igloolik is very low, heavily ponded and has extensive tidal foreshore flats. Most surficial deposits are only a veneer on the Palaeozoic beds with raised beaches being the most common features. Any drift deposits are subject to extensive frost action. Permafrost is present throughout with the active layer averaging 0.7 m.

A.5 Vegetation

Typical tundra vegetation such as mosses and lichens exist in the region.

A.6 Climate

The climate of Igloolik is distinctly Arctic with January mean high and low temperatures of -23.3°C and -32.8°C. The July mean high and low temperatures are 7.8°C and 3.3°C respectively. The total annual precipitation consists of 190.5 mm of snowfall. The prevailing winds are northeasterly and average 21 km/h. These winds contribute to heavy drifting during the winter.

B. MUNICIPAL SERVICES

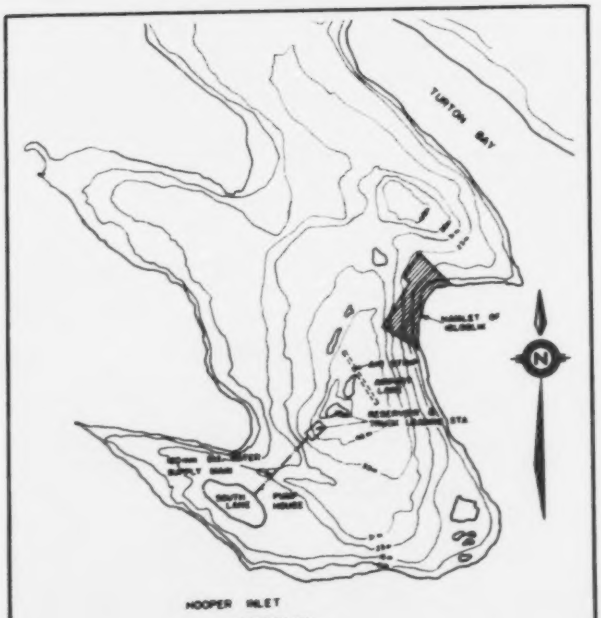
B.1 Water Supply

B.1.1 General

Prior to the construction of the new reservoir, the three following sources of water were utilized through the year:

- Airstrip Lake from late May to July after the spring thaw. Its recharge is not sufficient to supply the community year round. In addition, the lake freezes to the bottom in the winter.

- North Lake was the source from July to September. However, it was only used to a limited extent mainly due to its shallow water depth.



IGLOOLIK
WATER SUPPLY SYSTEM
SITE PLAN

- During the winter, East Lake was used. It is 3 m to 6 m deep, and 2.4 km long and has a large capacity. However, it is only accessible by a winter road across Turton Bay.

B.1.2 Source

The source of water for Igloolik is essentially from surface run-off entering South Lake and Airport Lake located about 4 km from the community. The watersheds are relatively small in area, however, sufficient annual recharge is available to supply the Hamlet over a 20 year design life. Water is pumped from South Lake to the reservoir located near the airstrip where it mixes with the water from Airport Lake. The water is of good chemical quality for domestic use as shown by the following representative data for Airport Lake.

(All values are in mg/L unless otherwise noted)

Parameter	**Range of Values**
pH	7.05 - 7.13
Alkalinity ($CaCO_3$)	84 - 92
Hardness ($CaCO_3$)	25 - 30
Colour	2.0 units
Turbidity (SiO_2)	1.0 - 1.6
Total dissolved Solids	128 - 142
Iron (Fe)	0.04 - 0.05
Nitrate (NO_3)	0.05 - 0.13
Nitrite (NO_2)	0.15 - 0.18
Calcium (Ca)	7.3 - 7.5
Choride (Cl)	7 - 9
Sulphate (SO_4)	<1.0
Sodium (Na)	1.8

(Analysis results from Report by Oliver Mangione McCalla & Associates Ltd., 'Report on Water Supply System, Hamlet of Igloolik', March, 1979).

B.1.3 Intake Facilities

An intake facility extends out into South Lake from the South Lake pumping station. Details are as follows:

Length:	30 m
Diameter:	160 mm
Material:	HDPE Type III, Class C pipe

The intake pipe is anchored by 16 kg concrete weights placed at 3 m centres. The intake screen is positioned approximately 2 m below the surface. The intake screen is all welded stainless steel with continuous slot construction. Screen slot openings are 1.5 mm with an open area of about 35%. The intake system is only used during the summer months to fill the reservoir by Airport Lake.

A skid mounted portable pumphouse unit is used to pump water to the reservoir. The unit consists of a pump and diesel engine complete with all internal piping and storage tank. The stations are connected to the intake and supply lines with the use of 'Quick Couplers'. The pump specifications are as follows:

Type: Centrifugal
Capacity: 27 L/s @ 523 kPa TDH
(350 Igpm @ 175' TDH)
Motor Drive: Diesel engine - 2000 RPM

B.1.4 Supply and Storage

Water is pumped to the reservoir from the South Lake pumphouse via a graded supply line. The specifications are as follows:

Length: 2000 m
Diameter: 160 mm
Material: HDPE Type III, Class C pipe

The storage facilities were constructed in 1979-80 beside Airport Lake. The reservoir consists of a rock excavation with the dimensions 73.7 m x 34.5 m x 10 m deep and a capacity of approximately 30,000 m³. It was designed to provide an accessible year-round water supply. If the watershed of Airport Lake is also used then the water supply requirements for the next 20 years can be met. The elevation of the site is approximately 52 m, allowing for a future gravity fed piped distribution system. The depth of the reservoir and vertical sides ensure that a minimum amount of water is lost due to ice formation. Seepage problems are minimized since the surrounding bedrock is constantly frozen.

B.1.6 Pumping Station and Truck Fill Point

A pumping station and truck fill point is located at the reservoir. A single intake system is provided, equipped with a screen and submersible pump. The intakes are approximately 46 m in length and rest on an incline extending to within 2 m of the reservoir bottom. The pump discharge line is 89 mm diameter polyethylene and is situated within a 250 mm diameter insulated polyethylene pipe. A 16 gauge CMP casing pipe 600 mm in diameter surrounds the intake. A heat trace cable within a 22 mm pipe embedded in the insulation is used as freezing protection. Broken rock surrounds and covers the casing. Steel and concrete anchors secure the pipe in place.

Pumping Facilities:

Pump Type,
Make & Type: Jacuzzi Submersible Turbine
Capacity: 7.6 L/s @ 180 kPa TDH
(100 Igpm @ 60'TDH)
Motor: single phase - 3500 rpm, 5HP
Screen: 250 mm diameter

Since the water is of good chemical quality only chlorination is provided. The hypochlorinator is a Wallace and Tiernan Series A-745.

The truck fill station contains the chlorinator and other equipment. The water truck is filled outside via an overhead pipe assembly.

B.2 Water Distribution

B.2.1 General

All water for domestic use is distributed by truck. According to the water truck supply records, the average consumption is only 4.5 Lpcd (1 Igpcd). This is a quite low figure, however, it should be noted that the supply is still supplemented by snow melting to some extent. Therefore, the actual consumption figure will be somewhat higher.

B.2.2 Trucked System

Water is distributed through the hamlet by a 4550 L (1000 Igal) wheeled truck. The contract is handled by the Co-op.

B.3 Sewage Collection

Most sewage is collected in bags. The nursing station and research centre have pumpout tanks.

All bagged sewage is placed in half barrels and is picked up by an open box wheeled trailer. This contract is held by the Co-op.

The nursing centre deposits its waste into a holding tank which is periodically emptied.

The research centre uses humus toilets. In this way their holding tank can be emptied once every 8 months instead of once every day.

B.4 Sewage Disposal

Sewage is disposed of at a location 0.8 km north of the Hamlet. Wastes and sewage are not segregated. They are bulldozed and covered with a layer of soil during the summer months.

Liquid sewage is dumped on the ground at the disposal area.

Greywater is discharged on the ground beside residences.

B.5 Solid Waste

B.5.1 Collection

Garbage is collected from 205 L barrels under the same contract and at the same time as bagged sewage pick-up.

B.5.2 Disposal

Most solid wastes are deposited at the same location as the sewage. Large metal objects are separated and piled at a spot another 0.8 km north, along the ocean shore.

B.6 Roads

There is an adequate amount of sand and gravel available for road construction and maintenance, especially in the area south of the airport.

All of the roads are surfaced with gravel laid directly on a graded ground surface. In winter the roads are essentially snow roads. The condition of the roads in the hamlet is adequate since most of the vehicles are either trucks or tracked machines.

B.7 Surface Drainage

There are some drainage problems in the Hamlet, most resulting from the extensive snow drifting and the shallow depth of the active layer. When the snow melts ponding occurs in depressions when culverts are blocked with ice.

B.8 Fire Protection

The fire protection system in Igloolik consists of the following:

- call boxes throughout the community directly connected to a siren - there are 58 people per call box;
- one standard triple combination fire truck capable of pumping over 34 L/s (450 Igpm);
- a firehall; and - 10 person volunteer fire brigade.

B.9 Other Services

Other services include two weekly flights, twice weekly mail service, telephone service by Bell Canada, an R.C.M.P. post and a nursing station. NCPC provides power with diesel generator facilities.

There is no newspaper, radio or T.V. service.

INFORMATION SOURCES

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2. Oliver Mangione McCalla & Associates Ltd., *Water Supply System, Hamlet of Igloolik,* March, 1979.

3. W.L. Wardrop & Associates Ltd., *Baffin Region Water Supply Program, Igloolik, N.W.T.,* March, 1972.

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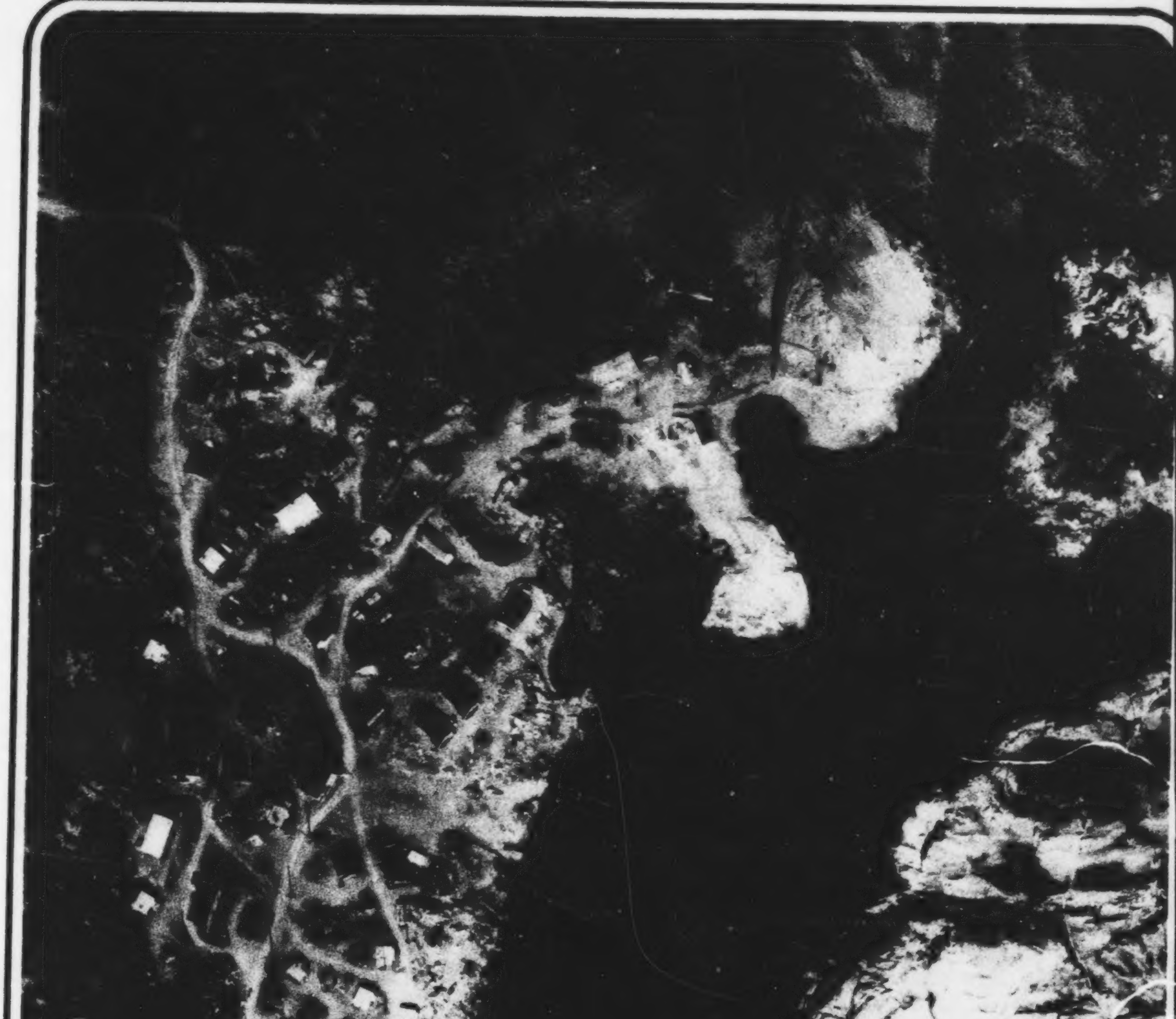
Lake Harbour



LAKE HARBOUR

SCALE - 1:7,500
N.A.P.L.
NO. A25552-70 & 71 2/8/80

A. GENERAL

A.1 Location

Lake Harbour is located on the southern end of Baffin Island on the Meta Incognita Peninsula at 62°51'N latitude and 69°53'W longitude. It is located at the upper end of a drowned valley some 23 km from the open sea. The settlement occupies a hummock at an elevation about a metre above sea level.

A.2 History

There have been Inuit in this vicinity for centuries, and they have been in contact with Whites since the mid 19th Century when they worked for the whalers. An Anglican Mission was established in 1900, a Hudson's Bay post opened in 1911, and the R.C.M.P. set up a post in 1924.

A.3 Community Information

The settlement of Lake Harbour is 93% Inuit and the overall population estimates for the past three years are as follows:

POPULATION	YEAR
301	1978
300	1979
297	1980

The population appears to be relatively stable at present.

Lake Harbour

The economy is based on local wage employment, hunting, the sale of handicrafts and some welfare. There is a nursing station, school and an R.C.M.P. constable located in the community.

A.4 Geology and Terrain

Lake Harbour is situated on an uneven deposit of granular glacial soil, hemmed in by high hills of precambrian rock with some deposits of limestone. Below the settlement there is a stoney beach at high tide level.

Bedrock is exposed extensively throughout the region and consists primarily of quartzite, schist and limestone. Quartzite and schist are resistant to the mechanical breakdown caused by the freeze-thaw cycles. Limestone is very susceptible to mechanical weathering. The area lies almost on a line separating the widespread discontinuous and continous permafrost zones, indicating that permafrost is present under most land areas to a depth of 60 m.

A.5 Vegetation

Vegetation is generally non-existent in the surrounding mountains with the exception of a few hardy mosses, lichens, or grasses.

A.6 Climate

Lake Harbour experiences unusually high temperatures for the Arctic and its sheltered location gives rise to rather mild winters.

The mean high and low temperatures for July are 12°C and 4.0°C respectively. January's mean high and low are -20°C and -27°C. Lake Harbour receives 202 mm of rain and 2100 mm of snow on average annually.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

The residents currently obtain water from Lake Fundo approximately 2 km west of the community. In the summer the intake hose is suspended in the lake and the truck is filled on the shore. During the winter a hole in the ice about 60 m from shore is kept open to fill the truck using truck mounted pumping facilities.

Cost effective analysis studies on water supply alternatives have been carried out by the G.N.W.T. The studies suggest that the preferred alternative is for a truck fill station at Lake Fundo and that the road linking the lake to the settlement be upgraded.

B.1.2 Source

The present source and apparently the most economical for present and future purposes is Lake Fundo. It is located 2 km west of the settlement at an elevation of 34 m ASL. A typical chemical analysis is as follows: (NOTE: All values in mg/L unless otherwise indicated)

Parameters	
Alkalinity ($CaCO_3$)	70.0
Total Hardness ($CaCO_3$)	90.0
Chloride (Cl)	15.0
Total Iron (Fe)	<0.04
pH	7.9
Nitrate (N)	<0.1
Calcium (Ca)	6.0
Magnesium (Mg)	18.0
Potassium (K)	traces
Sodium (Na)	traces
Sulphates (SO_4)	traces
Fluoride (F)	<0.1
Phosphate (PO_4)	<0.1
Total Solids	67.0

(Sampled by: Jack Grainge, National Health and Welfare, August 12, 1974).

B.2 Water Distribution

A total of 300 people were served during the 1980-81 fiscal year by trucked delivery. The water is picked up at Lake Fundo and delivered through the town by a 4550 L (1000 Ig) wheeled water truck. The community consumes about 62,000 L/week or 8755 L/day. Water is delivered to the buildings three times a week under contract by the local council.

B.3 Sewage Collection

Bagged sewage is collected 7 days per week, and sewage is pumped out three days a week using a trucked system.

Sewage truck

Bagged sewage is placed on the ground beside the garbage barrels and is picked up along with the garbage in an open truck box mounted on a Muskeg Bombardier.

Sewage pumpout is handled by a 4550 L (1000 Igal) pumpout truck.

The local council holds the contract that at present serves about 300 people.

B.4 Sewage Disposal

The sewage disposal area is located 3/4 km to the south of the community high in a valley. Access is over a winding gravel road. Sewage bags and liquid sewage are put into a man-made pit. Waste then leaches through the gravel and down a slope between the dump and the ocean inlet. Large tidal currents transport and dilute any effluent which enters the ocean.

B.5 Solid Waste

Solid waste is collected under the same contract as bagged sewage and is collected three days per week.

Abandoned bulldozers, trucks, washing machines and other mechanical devices are piled separately close to the new tank farm.

Garbage is deposited at the sewage dump site. It is regularly burned and covered yearly.

Winter in Lake Harbour

Garbage pickup

B.6 Roads

The roads in and around the community generally have steep grades. This can cause some problems with slippage, gas mileage, and higher wear and tear on vehicles. Many of the roads erode away during periods of rapid run-off. There are ample sources of gravel nearby for maintenance and construction.

B.7 Surface Drainage

Many of the roads are eroded by overland drainage. Proper drainage trenches, culverts and embankments would prevent this. The present haphazard arrangement of buildings also results in poor drainage of water. Dangerous ice sheets occur occasionally in the winter.

B.8 Fire Protection

The fire protection in Lake Harbour consists of the following:

- one mini-pumper capable of pumping 11-34 L/s (150-450 Igpm)
- 10 man volunteer fire brigade

B.9 Other Services

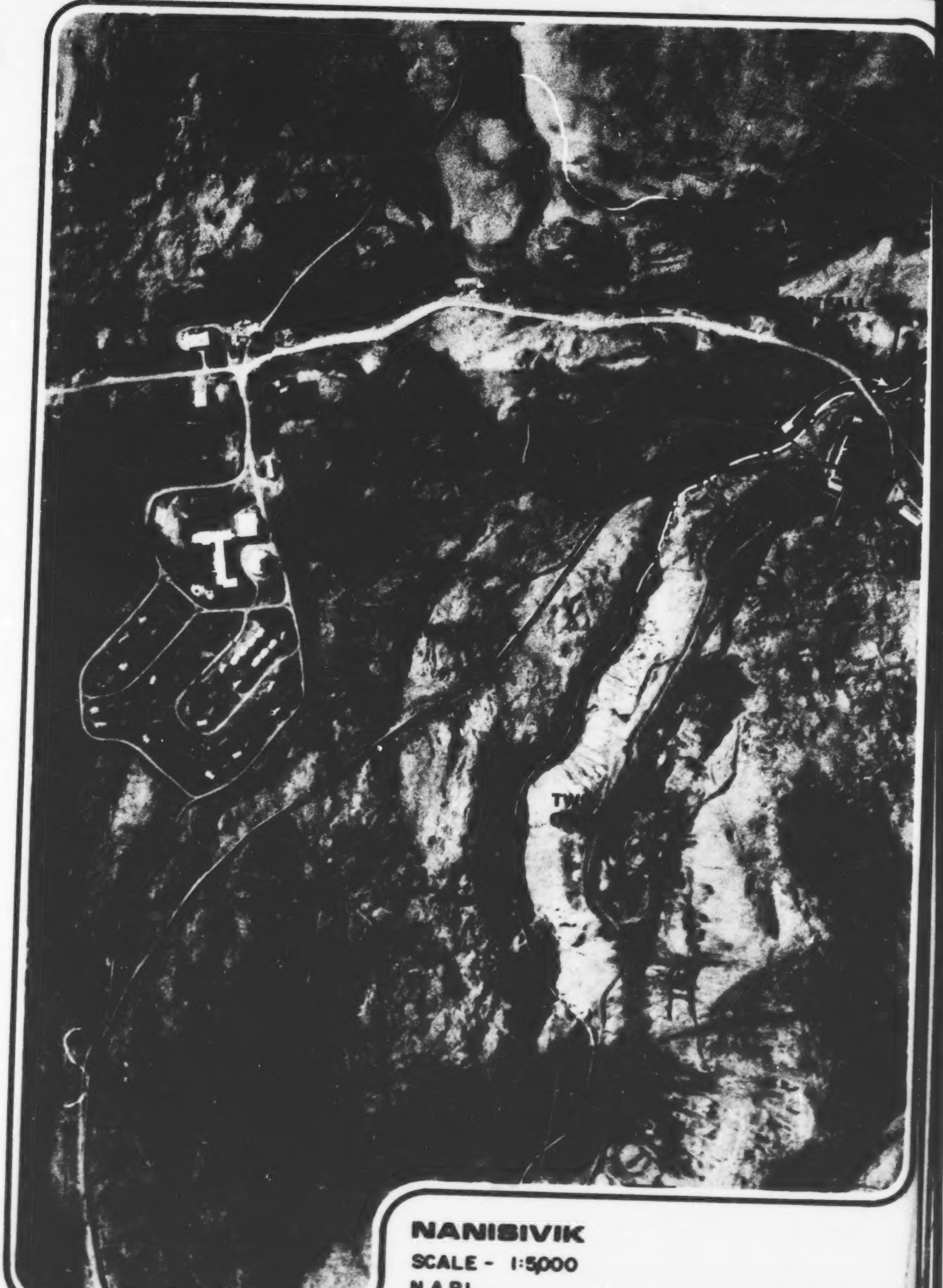
There is telephone service in Lake Harbour. Mail delivery is once a week from Frobisher Bay. Power is supplied by NCPC using diesel generator facilities.

INFORMATION SOURCES

1. Scott Brown, Department of Public Works, *Lake Harbour Water, Sewage and Garbage Pre-design Report*, April, 1980.

2. Jack Grainge, Health and Welfare Canada, Medical Services, *Report on Water Supply & Waste Disposal, Lake Harbour, N.W.T.*, March, 1977.

Nanisivik



NANISIVIK

SCALE - 1:5000

N.A.P.L.
NO. A25436-58 & 60 9/8/80

A. GENERAL

A.1 Location

Nanisivik is located 735 km north of the Arctic Circle at a latitude of 73°08'N and longitude of 84°25'W. It is situated on the south shore of Strathcona Sound, a deep water fiord off Admiralty Inlet on the Borden Penninsula of Baffin Island. The closest community to Nanisivik is Arctic Bay, 27 km to the west. Frobisher Bay is approximately 1280 km southeast.

A.2 History

The first recorded exploration of this region was by Admiral Perry in 1820. Mineral finds were first reported during a Canadian Government Expedition in the years 1910-11. By 1937, four claims were staked in the area. In 1954, R.G. Blockadar of the Geological Survey of Canada mapped the area and from then until 1974, exploration was continuous. The development of the lead/zinc mine and townsite at Nanisivik since 1974 has been under the direction of Strathcona Mineral Services Ltd.

A.3 Community Information

Nanisivik is classified as an unorganized settlement. Between 1978 and 1980 the population increased only slightly from 273 to 278. The economy of the community is dependent entirely on Nanisivik Mines Ltd.

Community services include two R.C.M.P. Constables, a primary school and a bank. There is a 1950 m x 46 m gravel runway southwest of the community, at an elevation of 640 m ASL.

A.4 Geology and Terrain

The geological formations in the immediate vicinity of the settlement consist of a platform of Society Cliffs dolomite about 11 km in length from east to west, and about 6.4 km wide from north to south along the south shore of Strathcona Sound. The southern boundary of the property is marked by the northern edge of the Adam Sound quartzite plateau. At the site, the elevation varies from sea level at the harbour to 640 m at the airport. Strathcona Sound is bordered by very steep sedimentary cliffs and bluffs. Natural sand and material suitable for crushing is found at a number of locations.

The predominant surface soils in the area consist of reddish coloured dolomite drift and thinly laminated softer dolomite shale in various degrees of weathering.

The permafrost is 15 cm to 20 cm below the surface in low lying areas and 90 cm to 120 cm in well drained areas.

A.5 Vegetation

Tundra vegetation is present in limited quantities. A small area of hardy grasses in the townsite and a few small patches of lichens are the only form of vegetation present.

Nanisivik townsite

A.6 Climate

The July mean high and low tempertures are 10°C and 2°C respectively. The January mean high and lows are -28°C and -33.5°C respectively. The average annual precipitation arrives as 58 mm of rain and 837 mm of snow. Winds are predominantly from the northwest at an average speed of 11.4 km/hour. Gusts up to 125 km/hour can occur.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

This system was built at the same time the mine and settlement was constructed. It serves both the settlement and the mill. The domestic and industrial water supplies are drawn from East and West Twin Lakes through similar intake facilities.

B.1.2 Source

East Twin Lake located about 3 km southeast of the community is the potable water source for Nanisivik. The chemical quality of the water is acceptable with its chemical characteristics meeting potable water standards. The lake has a volume of about 496 million L (109 million Ig), and an annual inflow of approximately 454 million L (100 million Ig) from the watershed.

A typical water quality analysis is as follows: (All values in mg/L unless otherwise indicated)

pH	7.40
Nitrite	<1
Total Coliform Counts/100 ml	<5
Suspended Solids 48 hrs.	<1
Hardness (as CaCO?)	13
Alkalinity (pH 3.7)	16
Conductivity umh/cm	28
Arsenic Total (As)	<0.01
Cadmium Total (Cd)	<0.005
Iron Total (Fe)	0.15
Mercury ug/L	<0.2

(Water samples collected on August 29, 1977, by D.I.A.N.D.)

The industrial supply for mine and mill use is taken from nearby West Twin Lake.

B.1.3 Intake Facilities

The intake consists of an upright 1.8 m diameter wet well buried inside 70 m gravel causeway extending to a water depth of 3.7 m. A pipeline from the base of the well extends to a water depth of 6 m. The water is heated by an electric submersible heater. There is a continuous overflow discharging back into the wet well.

B.1.4 Treatment

There is no treatment of the water supply at the present time.

B.1.5 Storage

Storage is provided by an insulated 681,900 L (150,000 Ig) standpipe reservoir. It is located on a hill east of the settlement and the top water level in the tank is slightly below the elevation of East Twin Lake.

Potable water intake/dumphouse

The storage tank was designed to supply a fire demand of 38 L/s (500 Igal/min) for 4 hours with a reservoir of 113,650 L (25,000 gal).

It also provides equalization for peak hour demands since the pumps are rated at the maximum daily flow requirement.

B.1.6 Pumping Facilities

There are two electric centrifugal submersible pumps situated in the intake line.

A 4.32 km transmission main extends to the mill with a 150 m branch line to the settlement and a 102 m line to the reservoir (see aerial photo).

The pipelines are 100 mm and 150 mm in diameter bearing the following specifications:

Type:	"Sclaircor" HDPE
Insulation:	50 mm polyurethane
Covering:	sheet metal cladding
Freeze Protection:	electric heat tracing cable

The reservoir is located above to the community and the mine mill creating 45.7 m of static head at the community and 122 m at the mill.

Domestic supply requirements have been based on an average day demand of 273 Lpcd, a maximum day demand of 545 Lpcd and a peak rate of 909 Lpcd for a population in excess of 850 people. The mill domestic requirements have been provided for at 31,822 L/day (7000 Ig/day).

B.2 Water Distribution

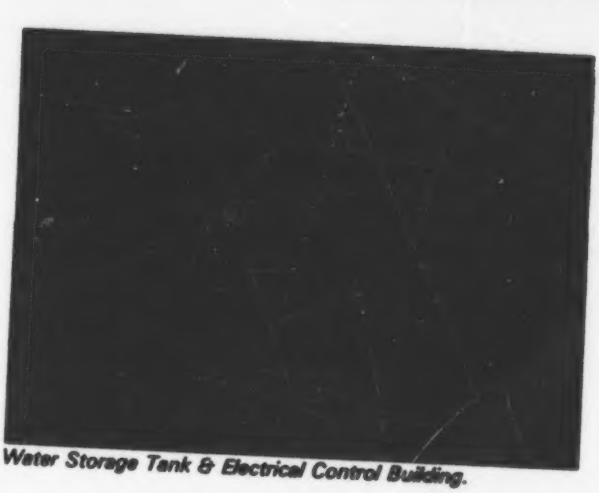
The townsite is serviced a utilidor utility system.

Water is distributed through 150 mm PVC mains with continuous recirculation. Water is supplied at a pressure between 276 kPa and 414 kPa (40 to 60 psi).

The distribution system is looped through the Town centre heating plant where recirculation pumps maintain a flow in the lines. Boilers are provided in the heating plant to maintain sufficient water temperature to prevent freezing of the water mains.

The utilidor houses the water line and sewer main within a plywood box insulated with styrospan. It is shallow buried at the rear lot lines. Circulation in the supply and return service connection loop is achieved by the velocity head created between two pitorifices which form part of the main connection. These lines are also traced with heating cable for emergencies.

Hydrants are spaced at strategic points.



Water Storage Tank & Electrical Control Building.

B.3 Sewage Collection

All sewage is collected via gravity mains contained in the utilidor. The sewage main consists of a 150 mm PVC pipe contained in the utilidor system with the water main. The gravity sewer system discharges sewage to the sewage treatment facilities described in the following section.

B.4 Sewage Treatment and Disposal

As part of the Nanisivik development, facilities for secondary sewage treatment of sewage were provided.

Initially, an Aer-o-Flo extended aeration treatment plant was constructed and used on a temporary basis. This plant was rated at 45,500 Lpd (10,000 Igpd) and was designed as part of the first stage of development at the site to serve a 100 man camp. It was located just north of the present townsite area. In 1977, new treatment facilities were constructed at a site located west of the mill and powerhouse (see

Bio Surf Unit/Rotating Biological Contactor Sewage Treatment Facility

aerial photo). The present system provides for primary settling and secondary aerated bio disc treatment followed by final clarification and chlorination prior to discharge.

The existing extended aeration plant was incorporated into the system and is used as a surge and sludge storage tank. This is followed by an Autotrol Bio Surf Unit which is designed to handle 180,000 Lpd (40,000 Igpd). The design service level was 400 people with an additional allowance of 32,000 Lpd (7000 Igpd) for the mill dry house - shower wastes. All components are housed in a 15.2 m by 12.2 m standard rigid frame pre-engineered building.

B.5 Solid Waste
Garbage is regularly picked up by an open truck and hauled to the disposal site.

The solid waste disposal area is located west of the settlement near the Stolport. A landfill method, with burning on a regular basis, has been adopted. Disposal is on the edge of a ravine with partial covering with dirt during summer periods.

The site drains westerly away from the townsite and other activity areas.

B.6 Roads
All road allowances are designed at a 15 m width with a 7.3 m gravelled carriage-way. There are ample sand and gravel deposits in the Twin Lakes area that are suitable for road construction and maintenance.

B.7 Surface Drainage
Site grading has provided for ditches and road culverts where necessary for storm water removal. Careful lot grading allows drainage away from the utilidor system to lessen the possibility of surface water entering into the box.

B.8 Fire Protection
There is room for a fire truck garage and office in the town centre building. Equipment consists of a fire truck with a 13,650 L (3000 igal) storage tank with a pumping capacity of 63 L/s when hooked to a hydrant. Manpower is provided on a volunteer basis. Major buildings have sprinkler systems installed. All units will have fire detectors and will be connected through an alarm system with the power house control centre.

B.9 Other Services
Other services include telephone service provided by Bell Canada and mail service five times a week. Power is generated by four 1500 KW diesel generating units at the mill pumphouse and is owned and operated by Nanisivik Mines.

Utilidor

INFORMATION SOURCES

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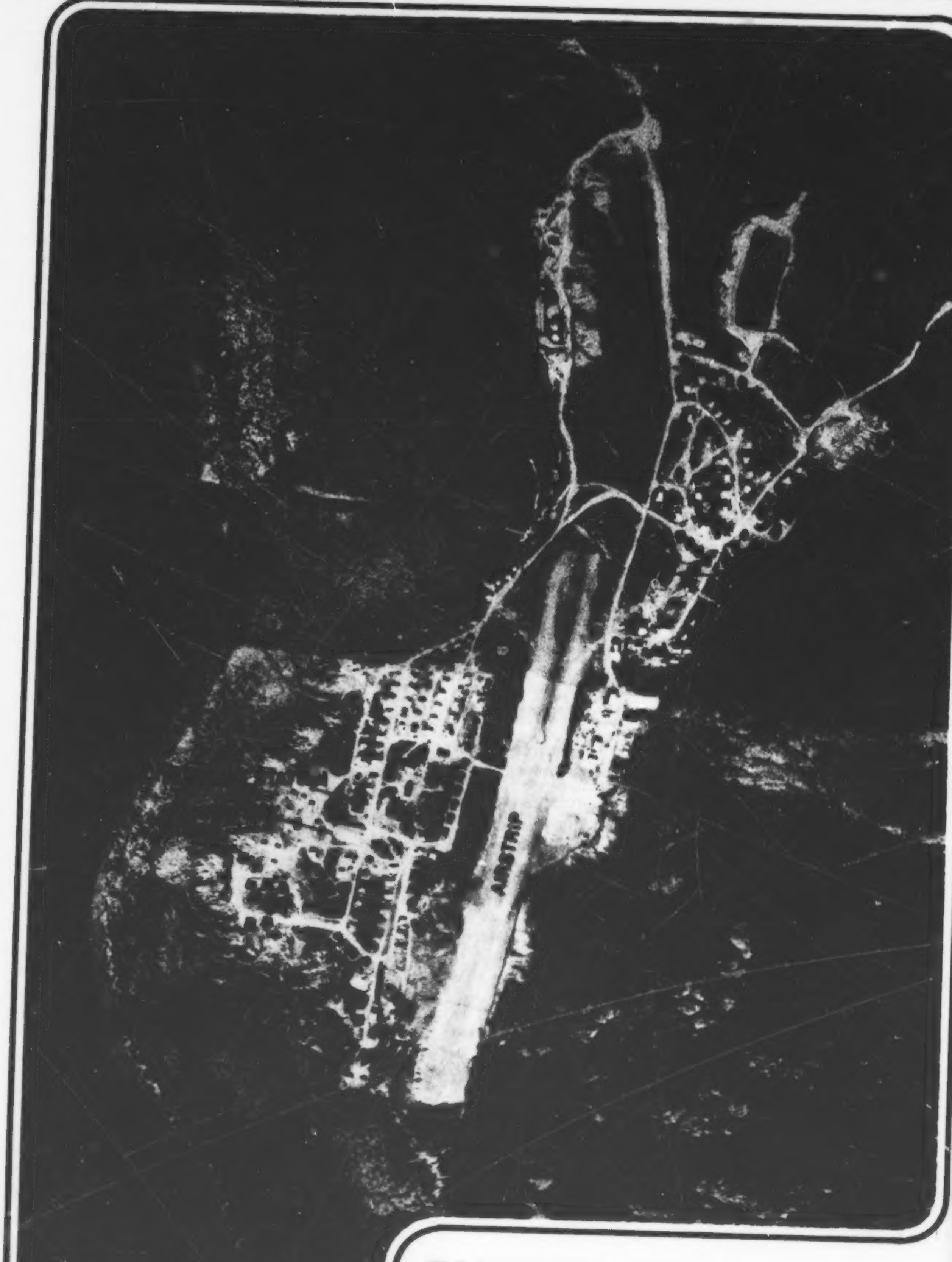
2. Government of the Northwest Territories, D.P.W., Specification; Nanisivik Sewage Treatment Plant Modifications, May, 1979.

3. Jack Grainge, Health and Welfare Canada, Medical Services, N.W.T. Region, *Report on Water Supplies & Wastes Disposal, Nanisivik, N.W.T.*, December, 1976.

Pangnirtung



PANGNIRTUNG

SCALE- 1:8,500

N.A.P.L.
NO. A25553-73 & 74 1/8/80

Aerial view

A. GENERAL

A.1 Location

Pangnirtung is located on the southeastern shore of Pangnirtung Fiord, Cumberland Peninsula, Baffin island at an approximate altitude of 66°09'N and longitude of 65°45'W. By air it is 300 km north of Frobisher Bay.

A.2 History

Whalers and explorers began visiting the area around 1600. An Anglican Mission became established at a whaling station at Black Lead Island, near the south shore of Cumberland Sound, in the late 1800's. The Mission moved to Pangnirtung in 1926. In 1921, the Hudson's Bay Company established a post and the R.C.M.P. started a detachment in 1923. Shortly after that, a hospital was built by the Mission in 1931. Over these years, a school was opened and a nursing station was also established.

A.3 Community Information

Pangnirtung achieved Hamlet status on April 1, 1972. Between 1978 and 1980, the population of the hamlet increased from 878 to 899, indicating a gradual annual increase. The economy of the community is mainly dependent on the Federal and Territorial governments. The Hudson's Bay Co. and Peyton Lodge also employ a sizeable number of the local people.

Community services include two R.C.M.P. constables, two nurses, community centre, primary school and library.

A 825 m x 30 m gravel surfaced airstrip bisects the community.

A.4 Geology and Terrain

The community occupies a position generally situated on the remains of a tidal beach, glacial drift and an old river delta inland from the present delta to the east. The maximum depth from foreshore flat to the plateau behind the community is about one-half mile The Hamlet is bounded on the north and west by the fiord, on the south by steep hills and on the east by the Duval River.

Sewage truck

A.5 Vegetation

Vegetation consists of mosses and lichens with the odd stand of hardy grasses.

A.6 Climate

The climate in Pangnirtung is severe. The July mean high and low temperatures are 11.1°C and 3.9°C respectively. The January high and lows are -25.6°C and -37.8°C respectively. The total average yearly precipitation of 341 mm consists of 162 mm rain and 1803 mm of snowfall.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.2 Source

During the summer, water is pumped into a storage reservoir from the Duval River at a point approximately 1 km east of the community for winter storage (see aerial photo).

During the summer, springs in the hills above town are used directly as a potable water source. Both the Duval River and spring waters are of good quality. A typical chemical analyses follows: (All values in mg/L unless otherwise noted)

Parameter	Duval River	Springs
pH	6.2	6.1
Total Hardness (as $CaCO_3$)	8	8
Total Alkalinity (as $CaCO_3$)	6	6
Iron, Total (Fe)	<.02	<.02
Manganese, Total (Mn)	<.02	<.02
Color	<5 units	<5 units
Turbidity	<1 unit	<1 unit
Nitrate Nitrogen (N)	0.2	0.2
Sulphate (SO_4)	<5	5
Fluoride (F)	<0.1	<0.1
Specific Conductance	25 micromhos	27 micromhos

B.1.3 Storage

During the summer, water is pumped into the reservoir from the Duval River. There it is stored for winter use. The construction of the reservoir in 1967 required burning fuel oil to melt the permafrost and bulldozing the frozen and unfrozen gravel. The reservoir is roughly 67 m x 183 m with 7.6 m high berms at the deepest end.

The useable volume of water assuming at least 2 m of ice, is in the range of 9 million litres (2 million Igal). With 0.6 m (2 ft.) freeboard, the useable volume with no ice, is roughly 18 million litres (4 million Igal).

An investigation in 1972 revealed seepage into and out of the reservoir and in 1976, a 30 mil Hypalon liner was added. Air vent pads were installed on the liner above the high water level at 10 m centres lengthwise and 4.6 m centres across the reservoir. The reservoir does not have a subdrainage system and liner "ballooning" has subsequently occurred due to water pressure build-up beneath the liner.

B.1.4 Intake Facilities

Intake facilities in the reservoir consist of an insulated underground heat traced pipe with the following specifications:

Length:	21.3 m
Diameter:	50 mm
Type:	Schedule 40 Steel Pipe

The deep well submersible pump is located in the intake and is used to fill the water truck.

B.1.5 Pumping Facilities

Pumping facilities consist of a deep well submersible pump in the intake. Pump specifications are as follows:

Type:	TRW Pleuger of Canada P63, 2 stage
Motor:	4-1/2 HP, 208 volt, 3 phase, 60 cycle
Capacity:	9.5 L/s @ 208 kPa TDH (125 Igpm @ 70' TDH)

Truck fill station at the reservoir consists of an insulated heated building includes chlorination facilities, water meter and storage space.

B.1.6 Treatment

Treatment is provided by a Wallace and Tiernan hypochlorinator equipped with a 136 L (30 Ig) polyethylene chemical feed tank and an electric mixer.

B.2 Water Distribution

All water is delivered by trucks except in the summer when some residences are served by a temporary piped system.

Water is delivered using two 4550 L (1000 Ig) wheeled vehicles with the contract being landed by

B.3 Sewage Collection

Bagged sewage and liquid sewage is collected by the Hamlet. Pumpout is via one 4510 L (1000 Ig) wheeled sewage pumpout vehicle. Only 20 residences, the school, and the nursing station have pumpout facilities.

Shoreline at Pangnirtung

Bagged sewage is collected daily along with the garbage. They are placed outside the houses in half barrels. These wastes are then hauled away to the disposal area using an open box truck.

B.4 Sewage Disposal

Presently bagged sewage and solid wastes are deposited in one of two places. One disposal area is about 1200 m northeast of the Duval River; however, this area is not always easily accessible. The road to this site is difficult to adequately maintain due to washouts from surface run-off, and snow drifting in the winter.

Sewage pumpout is dumped along the banks of the Duval River near its mouth.

Plans were underway to improve the present methods of disposal by constructing a macerator east of the Hamlet. This facility was intended to accept bagged sewage and pumpout liquid wastes and macerate the contents prior to disposal, these plans have been suspended pending further investigations on the design and operation of the facility.

B.5 Solid Waste

Garbage is placed in 205 L (45 Igal) drums and collected along with the bagged sewage. It is carried out under contract by the Hamlet and is presently disposed of in the same manner and location as sewage bags.

Plans were underway to construct incineration facilities designed to reduce the volume of wastes and, thereby eliminate nuisance and other disposal problems. These plans have been suspended until further investigations have been carried out on the cost effectiveness, and operational characteristics of the facilities.

B.6 Roads

Road surfaces throughout the community are generally in poor condition.

Good road building materials are not present in a natural state. Mixing and crushing operations would be required to provide a suitably graded material for road construction.

B.7 Surface Drainage

The steep inclines behind the Hamlet tend to produce a high peak volume in the spring-summer thaw. This results in a more active soil layer with a high degree of solifluction and soil creep. The present alignment of the roads also hinders surface drainage.

B.8 Fire Protection

Fire protection in Pangnirtung consists of the following:

- call boxes throughout the community directly connected to a siren
- one 1977 mini-pumper capable of pumping 11-34 L/s (150-450 Igpm)

- an office and firehall in one building
- a 10 person volunteer fire brigade

B.9 Other Services

There is twice weekly mail service, a local newspaper, and a telephone system operated by Bell Canada. Power is supplied by NCPC using diesel generation facilities.

INFORMATION SOURCES

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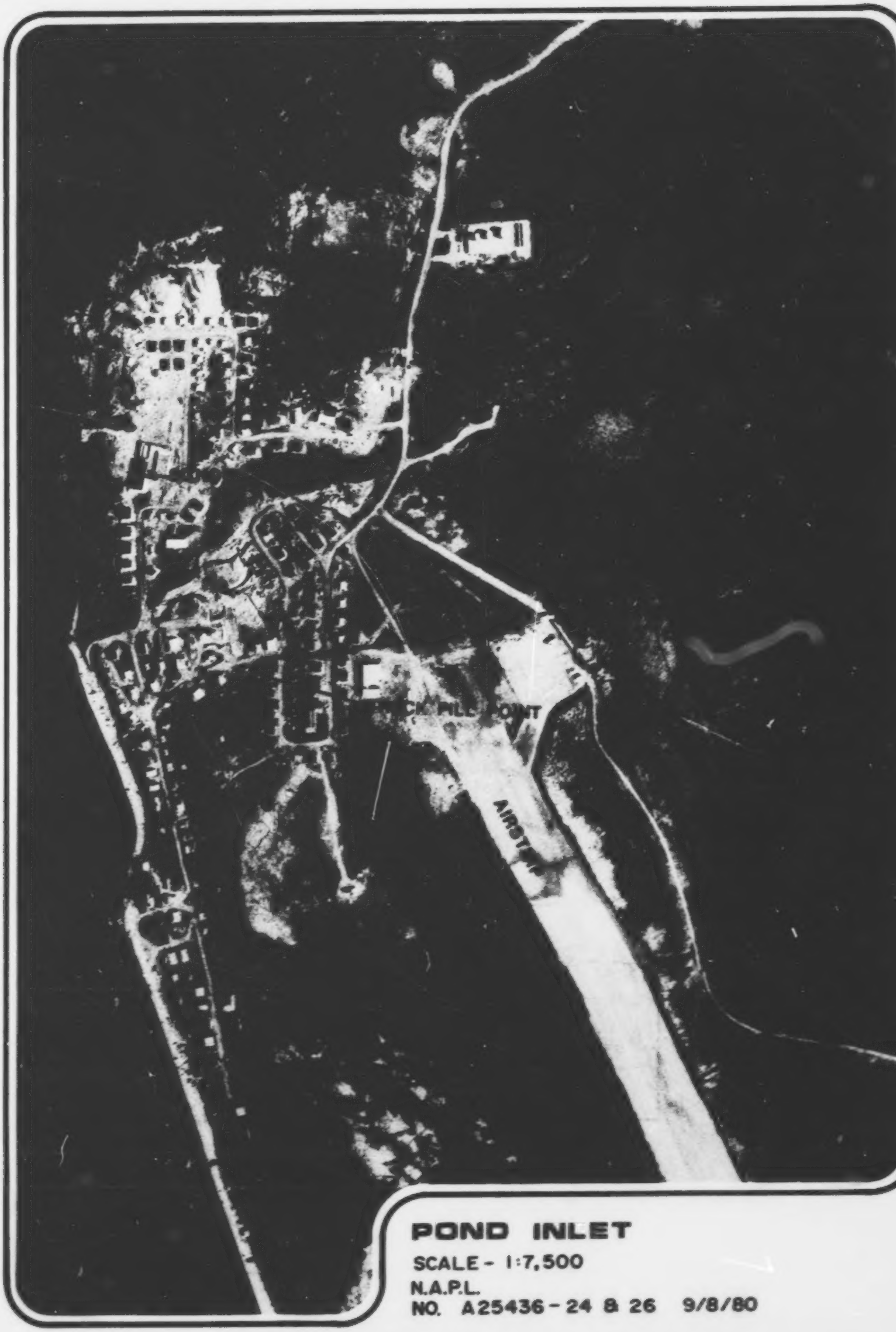
2. Health and Welfare Canada, Medical Services N.W.T. Region, *Report on Water Supplies & Wastes Disposal, Pangnirtung, N.W.T.*, November, 1976.

3. J.L. Richards & Associates Ltd., *Report on Waste Disposal Study Pangnirtung, N.W.T.*, January, 1980.

4. Government of N.W.T., Department of Public Works, *Specifications for Incinerator and Sewage Disposal Facility Panginirtung, N.W.T.*, May, 1979.

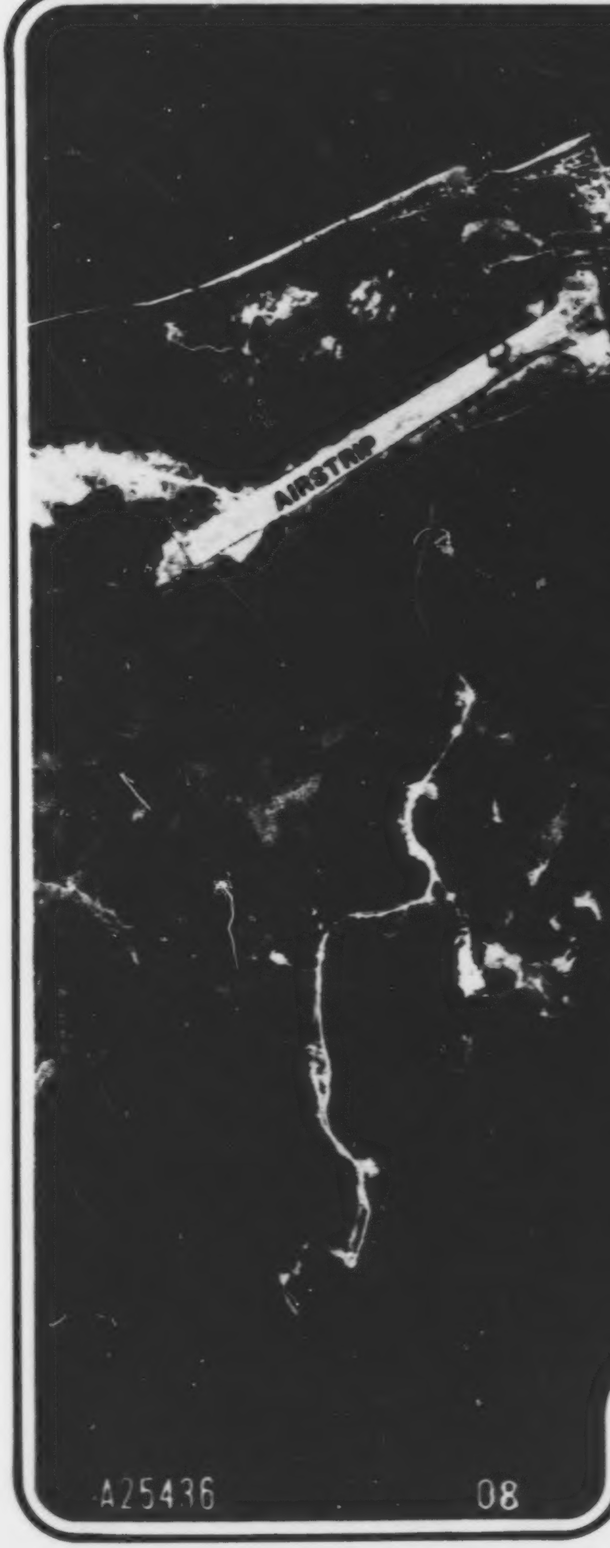
Pond Inlet


CK HILL POINT
AIRSTRIP

POND INLET

SCALE - 1:7,500

N.A.P.L.
NO. A25436 - 24 & 26 9/8/80


AIRSTRIP
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POND INLET

SCALE - 1: 21,000
N.A.P.L.
NO. A25436 - 8   9/8/80

Pond Inlet

A. GENERAL

A.1 Location

Pond Inlet is located at a latitude of 72°41'N and longitude of 78°00'W on Eclipse Sound in the northeast region of Baffin Island. It is approximately 575 km southeast of Resolute Bay.

A.2 History

Pond Inlet is also the name of the body of water between Baffin Island and Bylot Island. The inlet was discovered by Arctic Explorer, W.E. Parry.

In the period from 1880 to 1900, whalers and free traders frequented Albert Harbour, 27 km east of the present site.

The Hudson's Bay Company arrived in 1921 and the R.C.M.P. set up a post in 1922. In 1926, Catholic and Anglican Missions were established. A school was built by the federal government in 1960.

A.3 Community Information

Pond Inlet achieved Hamlet status on April 1, 1975. The population has only varied from 649 to 647 during the period 1978 to 1980.

The economy of the community is based primarily on hunting seal and whale, fishing, trapping and carving.

Community services include an R.C.M.P. detachment, a nursing station, two churches and a primary school. A 1220 m x 30 m gravel surfaced airstrip is located southeast of the community at an elevation of 57 m ASL.

A.4 Geology and Terrain

The settlement occupies a fairly hilly area near the south shore of Eclipse Sound. It is on the tip of an extensive glacial deposit. The glacial till is composed mainly of sand, with lesser quantities of gravel and silt.

A.5 Vegetation

Vegetation in Pond Inlet is sparse and consists primarily of mosses, lichens and a few hardy grasses.

A.6 Climate

The July high and low mean temperatures are 8.5°C and 1.5°C respectively. The January high and low mean temperatures are -28.4°C and -35.3°C. Pond Inlet receives a total of 145.3 mm precipitation yearly. Of this, 883.9 mm comes in the form of snow and 56.9 mm is rainfall. Prevailing winds are from the east and west and average 13 knots.

B. MUNICIPAL SERVICES

B.1 Water Supply

Prior to the present method of supply, two systems were used. In the summer, Pond Inlet Creek was the source of water until freeze-up occurred in mid-September. During the winter, a lake located southeast of the community was utilized as the source. The present source is the same lake known as

"Water Supply Lake". A supply line runs from the lake to a truck fill point in the Hamlet (see aerial photos). The water supply lake is located 4.5 km southeast of the Hamlet. It is 3.4 m deep and has a capacity of about 113 million L. In 1979 an earthen dam was constructed at a low corner in the lake to increase its capacity at the same time the supply pipeline was built. A typical analysis of the water source is as follows: (All values in mg/L unless otherwise noted)

Parameter	
pH	7.1
Total Alkalinity (CO_3)	15
Total Hardness ($CaCO_3$)	85
Color (APA Pt/Co)	25
Iron (Fe)	0
Turbidity	12 JTU
Total Dissolved Solids	118
Sulphate (SO_4)	25
Chloride (Cl)	0
Fluoride (F)	40 ppb
Cadmium (Cd)	<0.01
Chromium (Cr)	<0.01

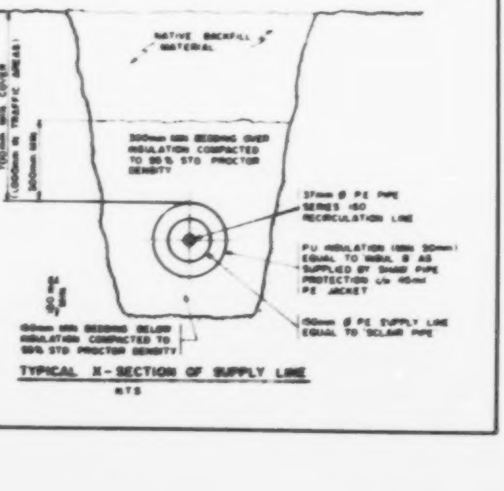
The water is relatively high in colour, and during winter and early spring, some taste and odour problems are experienced.

B.1.3 Intake and Supply Line

The intake pipe extends 92 m into the lake. The intake line includes 150 m polyethylene, Series 45 "Sclaircor" pipe with a 37 mm return line. The intake consists of a 90° elbow with a screen at the end.

The water flows to the truck loading point through a transmission main. Specifications are as follows:

Length:	4290 m
Diameter:	150 mm
Material:	Polyethylene "Sclaircor" Series 160
Depth of Bury:	Min. of 700 mm
Insulation:	Polyurethane, 50 mm
Covering:	45 mil polyethylene


NATIVE BACKFILL MATERIAL
700mm MIN COVER (1000mm IN TRAFFIC AREAS)
300mm MIN
300mm MIN BEDDING OVER INSULATION COMPACTED TO 90% STD PROCTOR DENSITY
37mm Ø PE PIPE SERIES 160 RECIRCULATION LINE
PU INSULATION (MIN 50mm) EQUAL TO INSUL 8 AS SUPPLIED BY SHAW PIPE PROTECTION c/w 45mil PE JACKET
150mm Ø PE SUPPLY LINE EQUAL TO 'SCLAIR' PIPE
150mm MIN BEDDING BELOW INSULATION COMPACTED TO 90% STD PROCTOR DENSITY

TYPICAL X-SECTION OF SUPPLY LINE

NTS

A 37 mm Polyethylene Series 160 recirculation line is enclosed in the transmission main. Heated water is pumped back to the lake to keep the line from freezing.

B.1.4 Water Distribution Point

Water flows from the lake to the truck fill station by gravity. The only pumps in the system are two recirculation pumps (one duty and one standby), and two truck loading pumps. Specifications are as follows:

Circulation Pumps (2 - one standby)

Type:	Astral boiler feed pump model X2
Capacity:	7.6 L/s @ 1370 kPa TDH (100 Igpm @ 460' TDH)
Motor:	5.6 KW, 3-phase, 60 Hz, 600 volts, 750 RPM

Truck Loading Pump (2 - one standby)

Type:	Peerless PV2-1/2 x 2-1/2 x 8 inline
Capacity:	7.6 L/s @ 60 kPa TDH (100 Igpm @ 20' TDH)
Motor:	.75 KW, 3 phase, 60 Hz, 600 volt, 1750 RPM

Chlorination is provided by a Wallace and Tiernan A-588 hypochlorinator. Sodium hypochlorite solution is used as the chlorine service. No other treatment is provided.

B.2 Water Distribution

Pond Inlet is served entirely by a trucked water delivery system. The Hamlet has two water trucks, both wheeled. One tank has a 4500 L (1000 Igal) capacity and the other has a 9000 L (2000 Igal) capacity. The trucks deliver water to the individual residences, the nursing station, the hotel and the school. Household storage tanks vary in size from 227 L (50 Igal) to 1135 L (250 Igal). Heavy usage tanks are located in the school - 13,600 L (3000 Igal), the nursing station - 4550 L (1000 Igal), and the hotel - 2270 L (500 Igal).

The delivery system operates on a 5 day week basis with replenishings occuring as many as 12 times per month or as little as three times.

B.3 Sewage Collection

Sewage is collected by means of bagged sewage pick-up and sewage pumpout. Only 10% of the homes at present are equipped with tanks that allow for pumpout.

The community council handles bagged sewage collection and disposal service.

Sewage bags are placed in 205 L (45 Igal) drum shells (cut in half longitudinally) located alongside the roadway for collection by hamlet employees. The bags are loaded onto a "Norman Wagon" which is pulled by an I.H.C. industrial tractor. Bagged sewage is collected as many as 18 times per month per residence.

Sewage pumpout is carried out by a 4550 L (1000 Igal) capacity pumpout truck. Houses with holding tanks have an access pipe with a knock-off cap. A suction line from the truck is inserted into the access pipe and activated by the truck mounted pump.

B.4 Sewage Disposal
Sewage is disposed of at a dump located 0.6 km east of the community.

The dump site is located between two rock outcrops which make the backfilling process difficult, due to the lack of backfill material.

The valley is sloped directly down to Eclipse Sound and the sewage seeps to the sea. Greywater from houses is deposited outside each house.

B.5 Solid Waste
Garbage is placed in 205 L (45 Igal) barrels and collected along with the bagged sewage and deposited at the dump site described in the earlier section.

B.6 Roads
Many of the roads in Pond Inlet are in poor condition, mainly due to the large amount of sand in the subgrade material. The roads generally follow natural ground contours. This often impedes surface drainage and results in culverts being repeatedly washed away.

B.7 Surface Drainage
The ground conditions do not allow the greywater to be absorbed and dissipated very quickly. This results in the formation of ponds and puddles.

No defined drainage scheme exists at present and the random location of houses hinders natural drainage patterns to some extent.

B.8 Fire Protection
Fire protection in Pond Inlet consists of the following:

- call boxes throughout the community directly connected to a siren
- a 1978 wheeled triple combination pumper capable of pumping over 34 L/s (450 Igpm)
- a 12 man volunteer fire brigade

B.9 Other Services
Other services include mail service and telephone communication provided by Bell Canada. Scheduled air service provides 2 weekly flights from both Frobisher Bay and Resolute. NCPC provides power from diesel generation facilities.

INFORMATION SOURCES

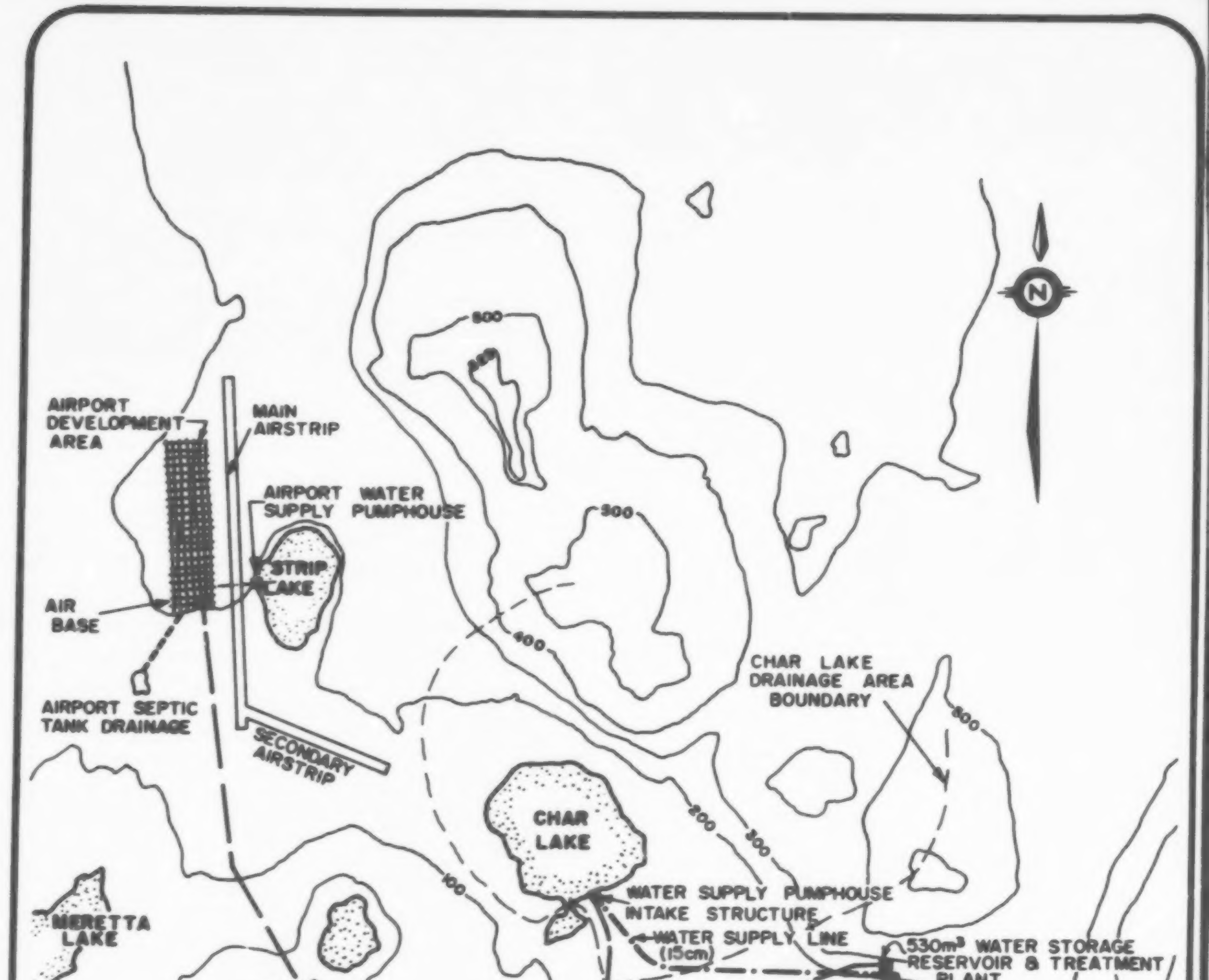
1. W.D. Buchanan Ltd., *Report on the Water Supply & Waste Disposal, Pond Inlet, N.W.T.*, March, 1978.

2. W.D. Buchanan Ltd., *General Development Plan, Pond Inlet, N.W.T.*, May, 1978.

3. Government of the Northwest Territories, Department of Public Works, Contract Documents, *Project: Water Distribution Point, Pond Inlet, N.W.T.*, May, 1979.

4. Government of the Northwest Territories, Department of Public Works, Contract Documents, *Project: Installation of Water Line, Pond Inlet, N.W.T.*, May, 1979.

Resolute Bay


500
300
400
200
300
500
100
50
50
50
AIRPORT DEVELOPMENT AREA
MAIN AIRSTRIP
AIRPORT WATER SUPPLY PUMPHOUSE
STRIP LAKE
AIR BASE
AIRPORT SEPTIC TANK DRAINAGE
SECONDARY AIRSTRIP
CHAR LAKE DRAINAGE AREA BOUNDARY
CHAR LAKE
WATER SUPPLY PUMPHOUSE
INTAKE STRUCTURE
WATER SUPPLY LINE (15cm)
530m³ WATER STORAGE RESERVOIR & TREATMENT PLANT
WATER SUPPLY & RETURN MAINS (200mm)
TOWNSITE
TO NEW DUMP SITE
SEWER OUTFALL LINE (20cm)
MECHAM RIVER
MERETTA LAKE
ROAD
ROAD
RESOLUTE LAKE
TIDE GUAGE JETTY
SOUTH CAMP INDUSTRIAL AREA FUEL STORAGE
GOVERNMENT DOCK
GRAVEL DEPOSITS
NARWHAL DOCK
RUINS LAKE
TO ABANDONED VILLAGE SITE & GARBAGE DUMP
RESOLUTE BAY
N

RESOLUTE

SCALE: APPROX. 1" - 3000'

DATE: APRIL / 81

New townsite

A. GENERAL

A.1 Location

Resolute Bay is situated on the south shore of Cornwallis Island approximately 900 km north of the Arctic Circle. Its geographic co-ordinates are 74°41'N and 94°54'W. It is 1560 air km northeast of Yellowknife and about 1550 air km northwest of Frobisher Bay.

A.2 History

Cornwallis Island has been an occasional Inuit hunting and fishing area for over a thousand years. Parry first sighted the island in 1819, when he was searching for the Northwest Passage. Resolute Bay was named in 1850 after the ship "Resolute" which spent the winter there that year.

Rowhouses

The airfield at Resolute was established in 1947 when the U.S./Canadian weather station was completed.

In 1953, Inuit from Port Harrison and Pond Inlet were relocated here. In the last decade Resolute Bay has developed into a major transhipment point for supplying the petroleum exploration activities further north.

In the early 1970s, it was decided to relocate the settlement from the beach area south of Resolute Lake to a new site as shown on the accompanying map.

A.3 Community Information

Resolute is classified as a settlement. The population is relatively steady, dropping only from 167 to 155 between 1978 and 1980.

There is a large increase in the summer during exploration activities and the sealift.

The main source of income for the residents is wage employment, supplemented by hunting and trapping activities.

One of the High Arctic's better airports is located at Resoute Bay. It consists of two gravel surfaced runways. One 60 m x 1980 m and a shorter crosswind runway of 45 m x 1220 m. The main strip is suitable for use by large jet passenger and transport aircraft.

P.W.A. provides scheduled air service to the settlement.

A.4 Geology and Terrain

Cornwallis Island is a part of the Innuitian Region in which most of the area has been worn down to a peneplained surface. The island is slightly dome-shaped with the highest part at an elevation of 300 m or more, a little to the southeast of the geographical center.

The shores of Resolute Bay are low and composed of Paleozoic limestones and shales. The land surface slopes gradually from the shore, generally in a series of stepped gravel ridges which appear to be raised beach lines.

Bedrock is located 1.5 m to 9.5 m below the surface. The depth of the active permafrost layer varies between 0.5 m and 1 m. The ice constant varies between 10% and 25% by volume.

A.5 Vegetation

Arctic tundra vegetation covers the area. Lichens grow on the rocky surfaces. During the summer, a few blades of grass manage to grow in the wetter areas around the lakes and streams.

A.6 Climate

The climate at Resolute Bay is typical of the cold dry Arctic environment. The mean daily high and low air temperatures for July are 7°C and 2°C. The January high and lows are -29°C and -36°C. The 137 mm total annual precipitation, 58.7 mm, comes in the form of rain and 787 mm is deposited as snow.

B. MUNICIPAL SERVICES

B.1 General

The new townsite is served by a utilidor system with Char Lake as the water source. The buildings at the air terminal and administration area are served by a piped pressure distribution system from Strip Lake. The south camp and buildings at the airport that are not on the piped systems are served by truck delivery.

B.1.1 Source

The source of water for the townsite is Char Lake located approximately 1.5 km west of the townsite.

Service connection

The buildings by the airport receive their water from a small lake located across the runway known as "Strip Lake".

Both of these sources provide an acceptable quality of potable water. A chemical analysis of a sample collected by the Department of Environment, E.P.S., Edmonton, is as follows: (All values in mg/L unless otherwise noted)

Parameter	**Char Lake**	**Strip Lake**
pH	8.1	8.0
Total Hardness (as $CaCO_3$)	112.0	92.0
Total Alkalinity	113.0	84.0
Iron, (Fe) Total	<0.02	<0.02
Manganese, (Mg) Total	<0.02	<0.02
Color	<5.0 units	<5.0 units
Turbidity	<1.0 JTU	<1.0 JTU
Nitrate Nitrogen (N)	<0.01	<0.03
Sulphate (SO_4)	21.0	7.0
Chloride	25.0	15.0
Fluoride (F)	0.50	0.40
Specific Conductance	250.0 mmho	190.0 mmho

(Sampled October 1, 1974)

B.1.2 Intake Facilities

A causeway, intake line and pumpwell has been built into Char Lake to place the intake in a minimum water depth of 4 m.

At Strip Lake, a similar gravel causeway has also been built into the lake. An intake structure and pumps have been built to deliver water by insulated pipeline to tanks in a storage building at the airport complex.

B.1.3 Treatment

Chlorination is provided by dual hypochlorite solution injector pumps (one for standby) located at the water treatment and storage facility.

B.1.4 Storage

An above ground insulated steel reservoir is located on a hill north of the townsite. Its 530,000 L (116,586 Ig) capacity was designed to provide for peak hour and fire demands. It is capable of meeting a fire demand of 4400 L/min (968 Igpm) for two hours.

The reservoir is situated at an elevation sufficient enough to provide distribution main pressures by gravity.

B.1.5 Pumping Facilities

The vertical turbine pumps are installed in the pumpwell. They are automatically controlled to operate on demand, based on the water level in the reservoir. The pumps are capable of supplying the maximum daily requirements of the townsite. Requirements are based on a population of 900 with an average demand of 320 Lpcd, with a maximum daily demand of 640 Lpcd and a peak hourly demand of 1280 Lpcd.

A shallow buried 150 mm urethane insulated polyethylene pipeline supplies water to the reservoir from Char Lake. A 75 mm diameter insulated return line is buried alongside the supply line in the same trench.

B.2 Water Distribution

B.2.1 Piped System

The townsite is fully serviced by a shallow buried water and sewer utility system.

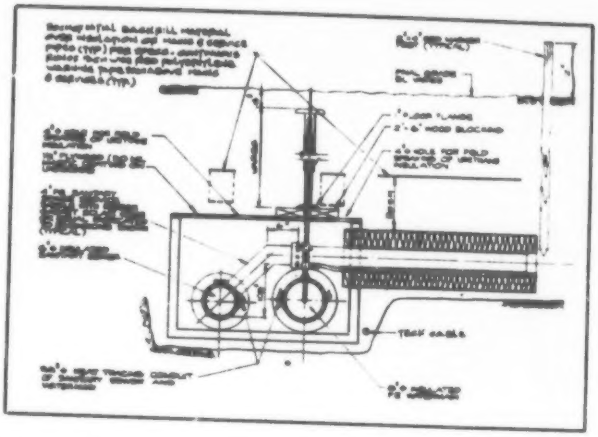
The 200 mm insulated polyethylene transmission main forms a single loop with continuous recirculation. The pumps are located at the storage facility. Boilers are used to maintain adequate water main temperatures and prevent freezing.

Pressure between 400 and 670 kPa is provided by gravity from the reservoir. The water mains are sized to provide for a combined fire demand and peak hourly flow at 5400 L/m while maintaining a residual pressure of 140 kPa.

The 20 mm copper lines into the houses are set in an insulated house service bundle. Two lines with two pitorifices allow circulation by the velocity head between the two.

Electrical heat tracing was installed for emergency purposes in the mains, but not in the service connections. Hydrants are placed at strategic points for fire protection purposes.

Service bundle



The buildings at the terminal and administration area are served by a piped distribution system.

Consumption at the airport is estimated at 30,000 L/day.

Between October, 1977 and October, 1978, the average water consumption was 264 Lpcd (58 Igpcd) with about 150 persons on the piped system and 50 in trucked pressure system. The consumption rate varied from 209 Lpcd (46 Igpcd) to 346 Lpcd (76 Igpcd) in the winter when bleeding of water lines took place.

B.2.2 Trucked System

The south camp and buildings at the airport that are not on the piped system are served by a wheeled tanker truck of about 9000 L capacity under private contract.

B.3 Sewage Collection

Sewage collection in the townsite is by gravity pipe collection forming part of the shallow buried system with the water mains. The sewer collection system utilizes urethane insulated, electrically heat traced polyethylene piping. The service line to the households is 100 mm diameter Series 60 HDPE. The main sewer line through the community is 150 mm, is wrapped with insulation and is protected by an outer plastic skin. The minimum design grade used for the 150 mm pipe was 0.6%.

B.4 Sewage Disposal

Sewage is presently untreated except for comminution prior to discharge to the bay. The outfall pipe is located at the shore of the Bay at the high tide water edge. It consists of a 200 mm polyethylene pipe wrapped with insulation and protected by an outer plastic skin. The last 3 m is contained in a 380 mm corrugated steel pipe, and the end is covered with a steel plate. An oval opening allows sewage to spill onto a long downward sloping concrete surface.

Sewage from the airport complex is conveyed to a holding tank. The effluent from the tank discharges into the water course of the upper reaches of the Meretta and Resolute Lake system.

Water and sewer trench

B.5 Solid Waste

B.5.1 Collection

Garbage is placed in 205 L (45 Igal) drums outside homes for pick-up. It is picked up on a regular basis using an open box truck and hauled to a centrally located storage container trailer unit which is taken to the disposal site when full.

B.5.2 Disposal

A new disposal area is planned for a site approximately 1200 m east of the community. There is adequate loose gravel and rock material available to cover the wastes on a regular basis.

B.6 Roads

Roads in Resolute Bay are gravel surfaced and are built-up above the surrounding surface to discourage creation of snowdrifts. Roads are graded so that slopes are 7% or less. The roads in the community have surfaces 8 m wide with 15 m rights-of-way.

B.7 Surface Drainage

There are no serious drainage problems in Resolute Bay due to the gravelly nature of the surface layer. The porous nature of the soil eliminates most ponding problems. Site grading allows for adequate drainage and culverts are used as required.

B.8 Fire Protection

Fire protection in Resolute Bay consists of the following:

- one 1972 tracked mini-pumper capable of pumping 11-34 L/s (150 - 450 Igpm)
- a 10 man volunteer fire brigade

B.9 Other Services

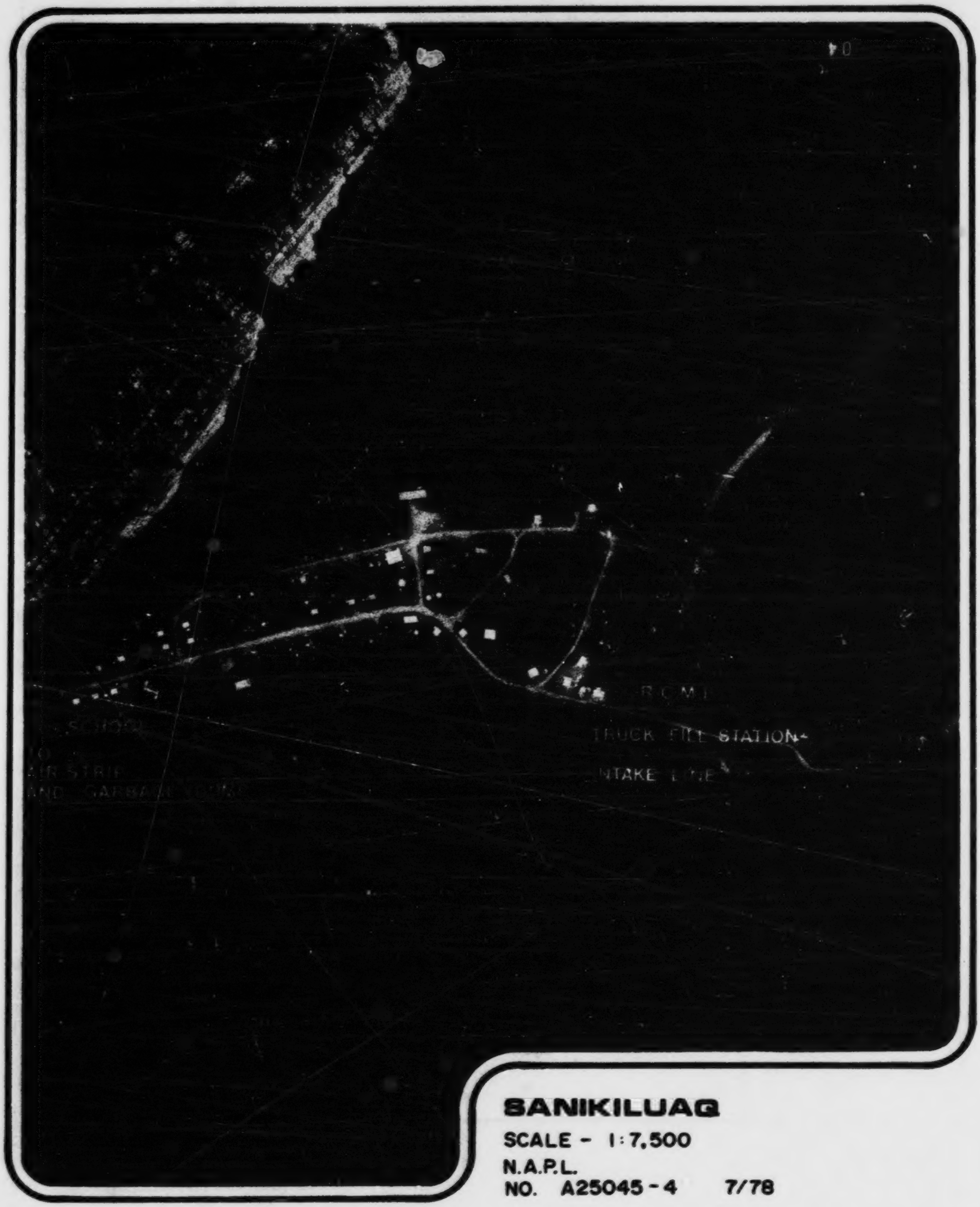
Other services include twice weekly mail service, a bi-monthly newspaper, telephone service by Bell Canada, and a bank. NCPC provides power with diesel generating facilities.

INFORMATION SOURCES

1. Underwood McLellan & Associates Ltd., *General Development Plan, Resolute Bay, N.W.T.,* December, 1977.

2. Underwood McLellan & Associates Ltd., *Report on Study of Pollution Control Systems, Resolute, N.W.T.,* September, 1974.

Sanikiluaq


R.C.M.P.
SCHOOL
TRUCK FILL STATION
TO
AIR STRIP
AND GARBAGE DUMP
INTAKE LINE

SANIKILUAQ

SCALE - 1:7,500
N.A.P.L.
NO. A25045 - 4 7/78

Sanikiluaq

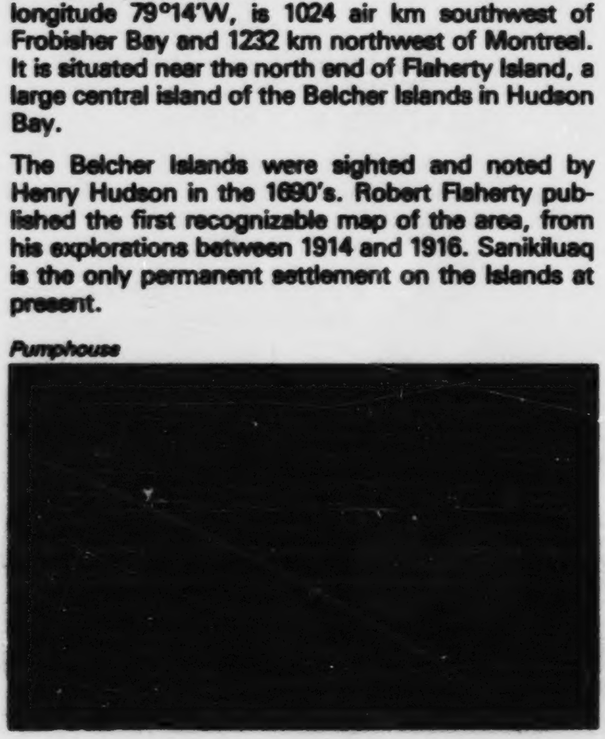
A. GENERAL

A.1 Location

Sanikiluaq is located at latitude 56°32'N and longitude 79°14'W, is 1024 air km southwest of Frobisher Bay and 1232 km northwest of Montreal. It is situated near the north end of Flaherty Island, a large central island of the Belcher Islands in Hudson Bay.

The Belcher Islands were sighted and noted by Henry Hudson in the 1690's. Robert Flaherty published the first recognizable map of the area, from his explorations between 1914 and 1916. Sanikiluaq is the only permanent settlement on the Islands at present.

Pumphouse



Sanikiluaq achieved Hamlet status on April 20, 1967. Between 1978 and 1980, the population of the hamlet grew from 326 to 370.

The economy of the community is based on wage employment by government institutions, hunting, fishing and handicrafts. Ring seals and ducks are the most common game. A gravel surfaced runway is located east of the settlement. It is 1160 m x 30 m in length and width.

Typical Arctic tundra vegetation, predominantly mosses and lichens, exists in this area.

The mean high and low temperatures in July are 25.6°C and 3.3°C, respectively. The January mean high and low temperatures are -22.8°C and -42.8°C. The prevailing winds are from the northwest.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Prior to the construction of the present intake system, the water delivery truck obtained water directly from Lake Sanikiluaq. An improved system with intake and pumphouse was constructed in 1979.

B.1.2 Source

The source of the water supply is a large deep body of water known as Lake Sanikiluaq. It is located near

Sanikiluaq/former truck fill point

the edge of the community. The chemical quality of the water is suitable for domestic use.

Following is a partial chemical analysis on a water sample collected by Water Resources, DIAND on June 22, 1978 from Sanikiluaq Lake near the present intake: (All values in mg/L unless otherwise noted)

Parameters	**Values**
p H7.3	
Sp conductance	175 umho/cm
Calcium (Ca)	21.4
Hardness (as $CaCO_3$)	69.3
Iron (Fe)	<0.04

B.1.3 Intake Facilities

The intake extends approximately 141 m into the lake at a depth of about 5 m.

It consists of two pipes running from the pumphouse to a point below the winter ice level. Here they combine to form one pipe running to the intake screen. Specifications are as follows:

1st Section	**2nd Section** (2 pipes)	(1 pipe)
Length	56 m	85 m
Diameter	250 mm	160 mm
Type	HDPE	HDPE
Series	100	125
Insulation	50 mm urethane	none
Freeze Protection	heat traced	none

The upper section is the portion of the intake most susceptible to freezing. Accordingly, two pipes are provided in this section such that if one does freeze then the second pipe may still be functional.

The intake screen consists of an all welded continuous slot construction screen with a capacity of 454 L/min (100 Igpm).

B.1.4 Treatment

Treatment consists of a Wallace and Tiernan Series A-745 hypochlorinator with a 227 L (50 Igal) polyethylene solution feed tank. This is located in the truck fill station at the edge of the lake.

B.1.5 Pumping Facilities

There are two identical submersible pumps in the intake facilities, one in each intake pipe. Pump specifications are as follows:

Type:	F.E. Myers & Bro. Co.
Capacity:	7.5 L/s @ 150 kPa TDH (100 Igpm @ 50' TDH)
Motor:	208 volts, 3 phase, 5HP, 3500 RPM

B.2 Water Distribution

The distribution of water is entirely by trucked water delivery. A six wheel drive truck (1976) with a 4550 L (1000 gal) water tank is used.

B.3 Sewage Collection

Sewage collection is entirely by bagged sewage pick-up. The bags are placed in 205 L (45 Igal) oil drums outside each home. They are collected and hauled away in the open box of a 3/4 ton 4 wheel drive truck. The filled drums are loaded on to the truck by the hoist of a 1970 International 2444 farm tractor.

Wash water is discharged directly onto the ground beside residences.

B.4 Sewage Disposal

The sewage is hauled to an open dump located southwest of the community across the harbour; the distance by road is about 2.9 km.

B.5 Solid Waste

Garbage is placed in 205 L (45 Igal) barrels and picked up and disposed of along with the bagged sewage.

B.6 Fire Protection

Fire protection in Sanikiluaq consists of the following:

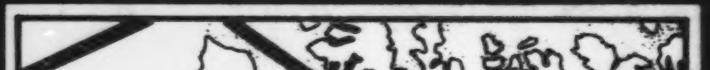
- one 1971 tracked mini-pumper capable of pumping 11 - 34 L/s (150 - 450 Igpm)
- 8 man volunteer fire brigade

INFORMATION SOURCES

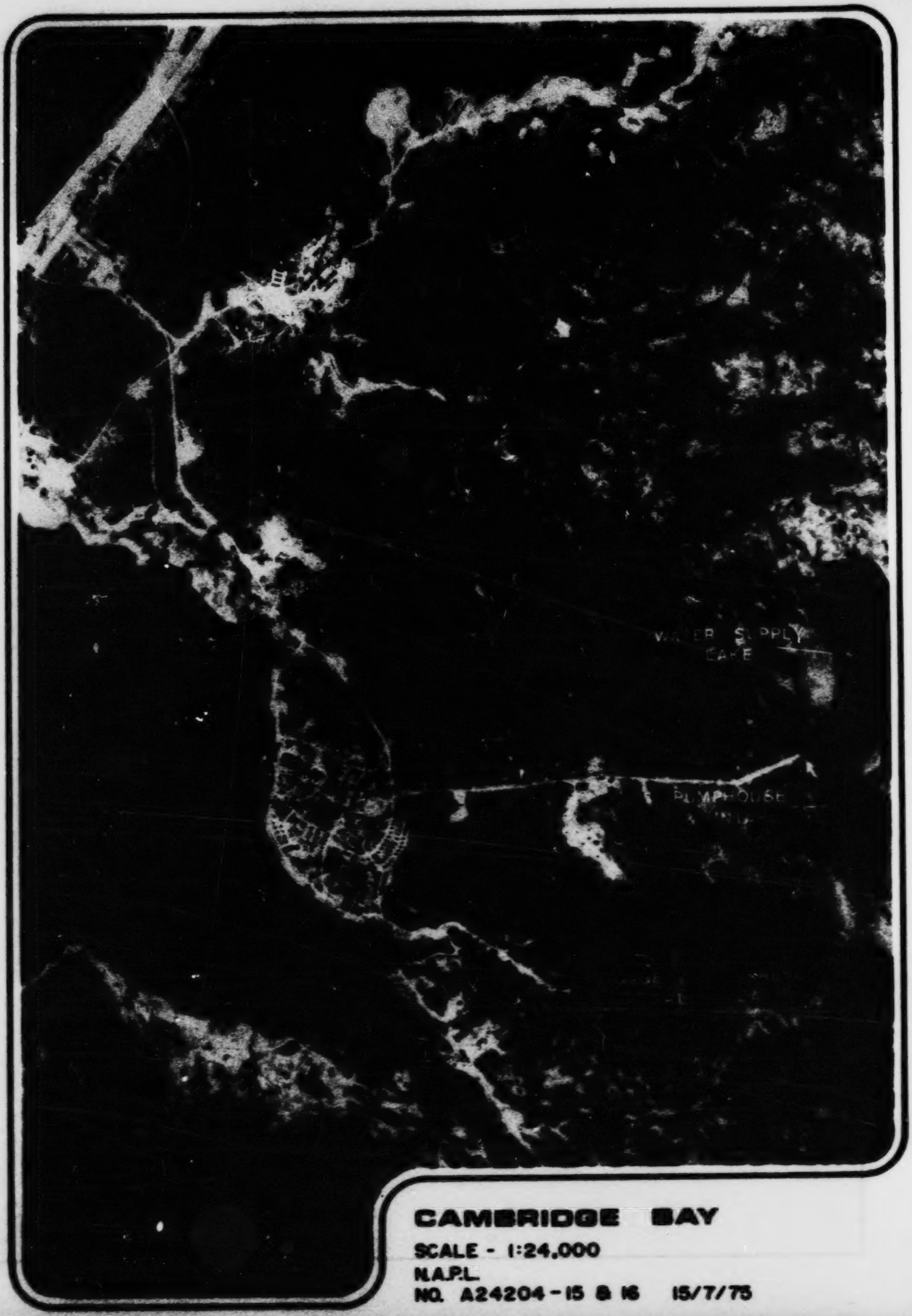
1. Health and Welfare Canada, Medical Services, W.T. Region, *Report on Water Supplies and Vastes Disposal, Sanikiluaq, N.W.T.*, December, 1976.

2. Government of the Northwest Territories, *Project: Water Supply, Hamlet of Sanikiluaq*, N.W.T., May, 1979.

CENTRAL ARCTIC REGION



Cambridge Bay


WATER SUPPLY
LAKE
PUMPHOUSE
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CAMBRIDGE BAY

SCALE - 1:24,000
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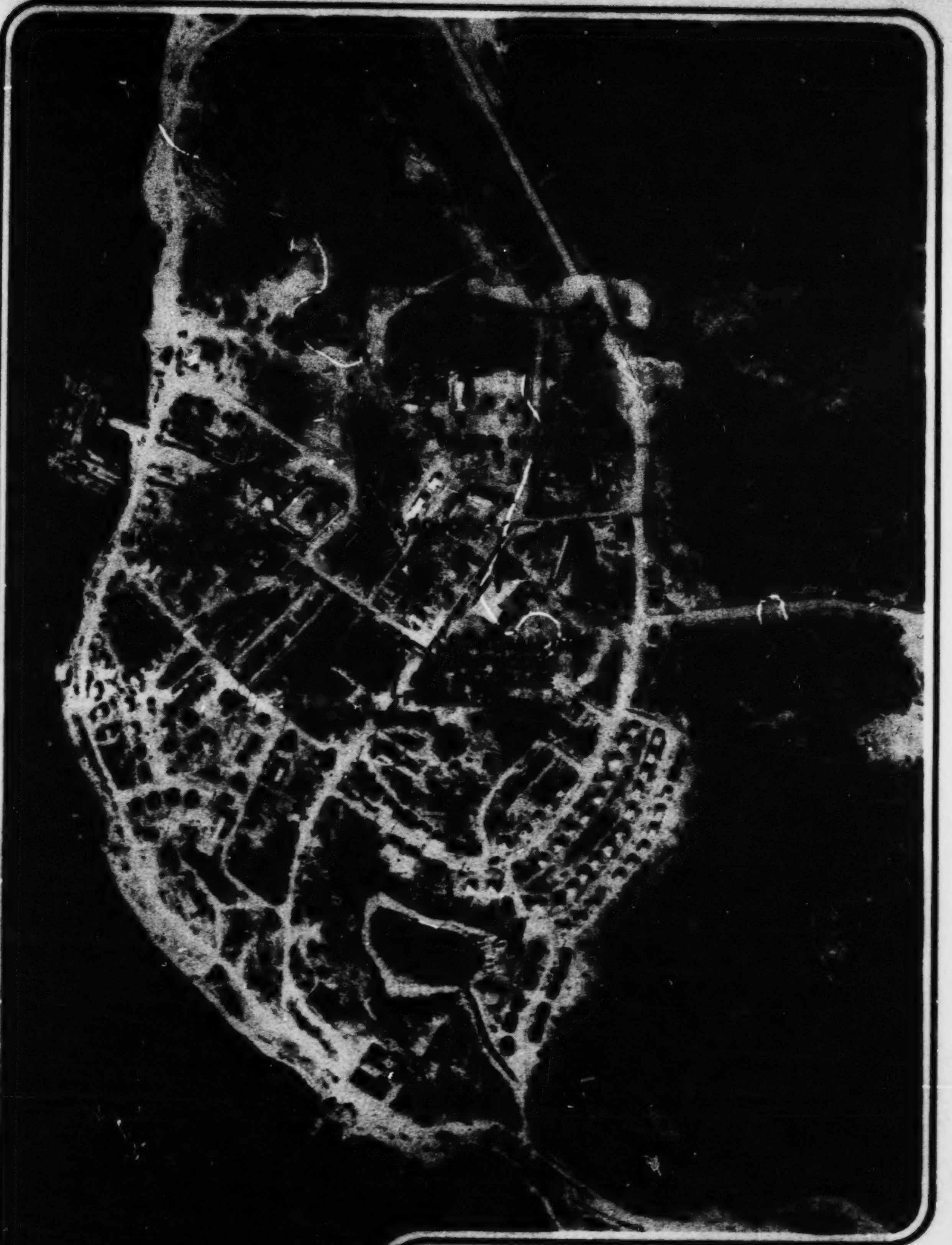
NO. A24204 - 15 & 16 15/7/75



CAMBRIDGE BAY

SCALE - 1:6,000

N.A.P.L.
NO. A24204-42 & 43 15/7/75

A. GENERAL

A.1 Location

Cambridge Bay is located on the southeast coast of Victoria Island. It is about 980 air km northeast of Yellowknife and some 320 km north of the Arctic Circle. The geographical co-ordinates of the settlement are 69°04'N latitude and 105°04'W longitude.

A.2 History

Cambridge Bay has been an important locale to the Inuit for hundreds of years because of its abundant game. Some of the people in this region used native copper for many of their implements, thus earning the name 'Copper Eskimos'. The first Hudson's Bay Company trading post was built at Cambridge Bay in 1921. The R.C.M.P. have operated a detachment at Cambridge Bay since 1926.

Construction of the LORAN beacon and later the DEW line provided employment for the natives and created a growing settlement.

A.3 Community Services

Cambridge Bay is classified as a settlement. The population has been increasing slightly over the past few years as indicated by the following population figures.

POPULATION	YEAR
853	1978
864	1979
907	1980

Wage employment is provided by the Territorial Government, and the DEW line. The economy is also supported by commercial fishing and some hunting and trapping.

A 1524 m x 45 m gravel runway at an elevation of 27 m ASL is located west of the community.

A.4 Geology And Terrain

The general area is covered by numerous relatively shallow lakes of various sizes. The shore is generally flat, close to the water, and rises to an elevation of 15 m. The most significant land form in the area is Mount Pelly, a drumlin shaped hill approximately 16 km to the northeast.

The area has been glaciated, leaving remnant knobs and ridges of sedimentary bedrock above the kettled till plain. The till particles tend to be sub-angular rather than well rounded.

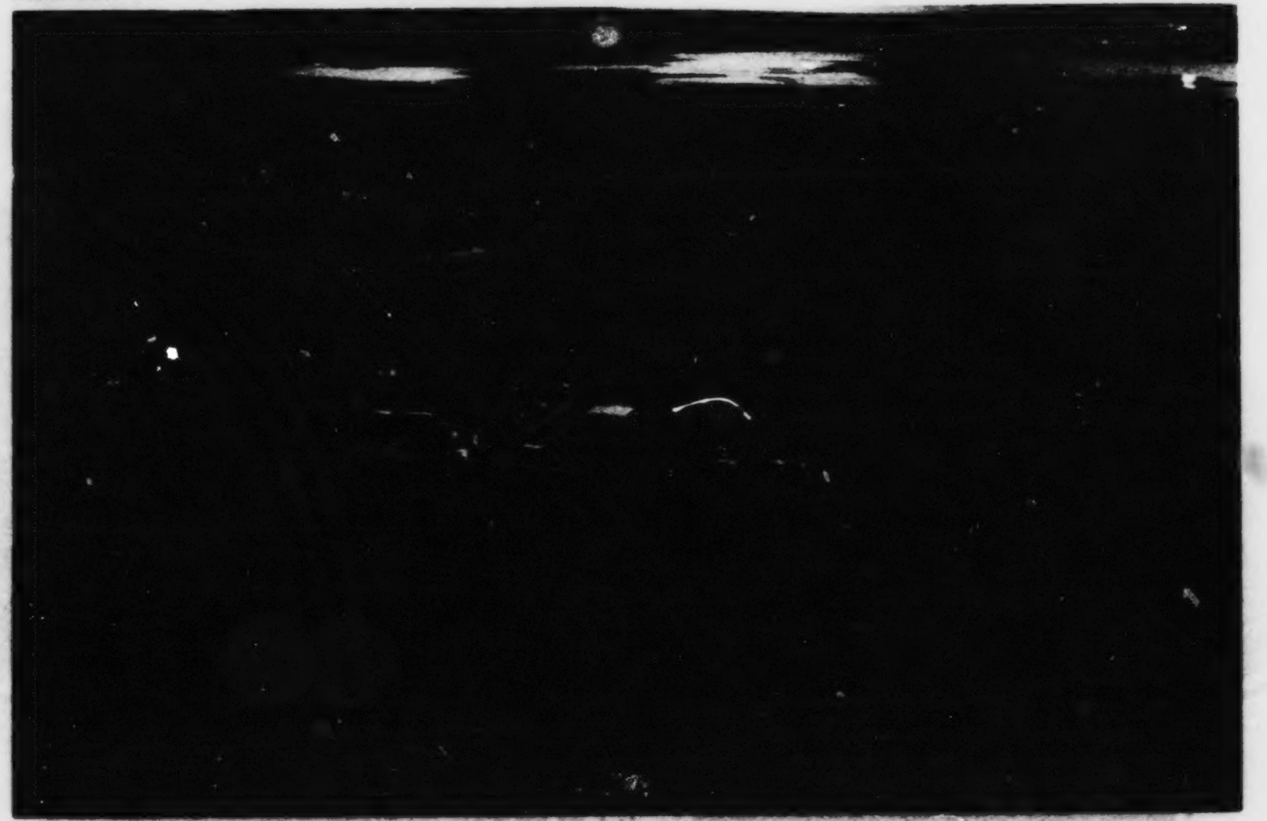
A.5 Vegetation

Some hardy grasses grow in lower wet areas where there is a thin layer of soil cover. Rock outcrops support lichens on their surfaces. Clusters of hardy willows manage to grow to a height of 0.5 m in well sheltered areas.

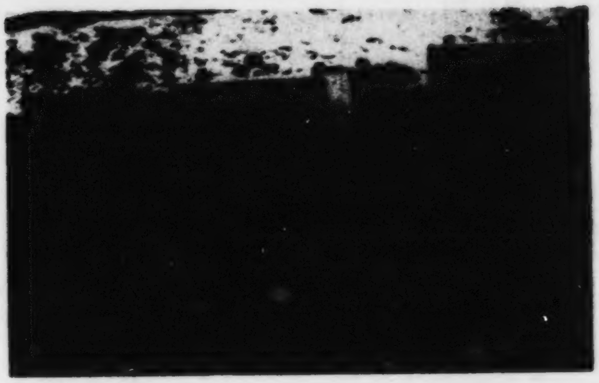
A.6 Climate

The climatic conditions of Cambridge Bay are typical of the arctic coastal regions. The July mean high and low temperatures are 12.0°C and 4°C

Aerial view



Water intake during construction



respectively. The January mean high and low temperatures are -29°C and -36°C respectively. Precipitation consists of 67 mm rainfall and 702 mm of snow.

The predominant winds are northwesterly, with the average wind speed being around 12 km/hour.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

In the past, water was obtained from three sources, depending on the period of the year. Freshwater creek, above tidewater, was the summer source. A lake about 1.6 km north of the settlement was used during spring and fall.

B.1.2 Present Source

The present source is Water Supply Lake 2 km north of the community. (see aerial photo). The catchment area for the lake is 231 ha (571 acres). It has a summer storage volume of 1,738,000 m³ and a winter storage volume of 544,000 m³ with 2.5 m of ice. It is in an area far from human activities and, as such, is relatively free from potential contamination. Although the hardness increases in the winter the water is suitable for domestic consumption. A chemical analysis of a sample collected by the Department of National Health and Welfare is as follows: (NOTE: All values in mg/L unless otherwise indicated)

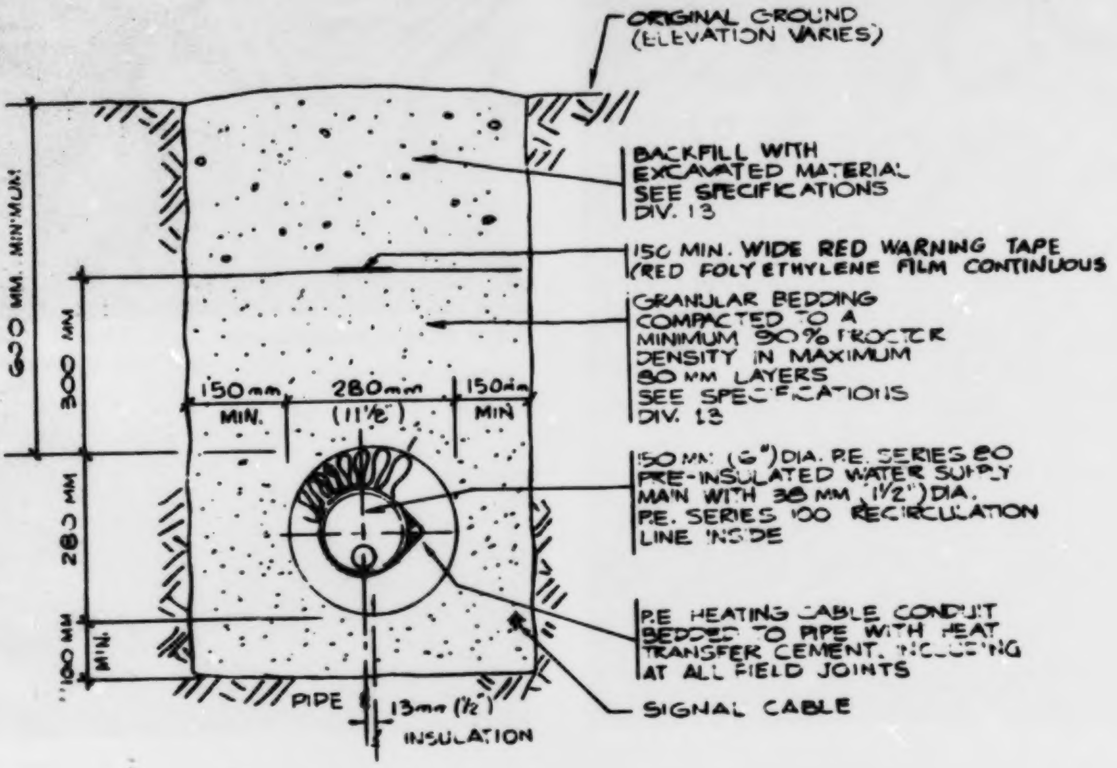
PARAMETER	
pH	6.2
Total Hardness ($CaC0_3$)	4
Total alkalinity as $CaC0_3$	4
Iron (Fe)	0.9
Manganese (Mn)	0.91
Colour	25 Units
Turbidity	10 JTU
Nitrate nitrogen ($N0_3$)	L0.1
Sulphate ($S0_4$)	1
Chloride (C1)	4
Fluoride (F)	0.09

B.1.3 Intake Facilities and Supply—Line

The intake facilities extend 20 m into Water Supply Lake to a depth of approximately 4 m below the surface. A 'Johnson' surface water intake screen made of stainless steel, with slot openings of 0.50 mm, prevents debris from entering the system.

The pump discharge line consists of 81 m of 100 mm HDPE Series 100 pipe. This line is coupled to a submersible pump at the intake and rests within a HDPE intake shaft or casing pipe. The casing is 250 mm HDPE Series 45 pipe which is insulated with 50 mm of polyurethane, complete with a polyethylene jacket for protection. Electrical heat tracing cable protects discharge pipe below the water line.

A transmission main runs from the intake facilities to the distribution pumphouse. It contains a smaller


ORIGINAL GROUND
(ELEVATION VARIES)
BACKFILL WITH EXCAVATED MATERIAL SEE SPECIFICATIONS DIV. 13
150 MIN. WIDE RED WARNING TAPE (RED POLYETHYLENE FILM CONTINUOUS
GRANULAR BEDDING COMPACTED TO A MINIMUM 90% PROCTOR DENSITY IN MAXIMUM 80 MM LAYERS SEE SPECIFICATIONS DIV. 13
150 MM (6")DIA. P.E. SERIES 80 PRE-INSULATED WATER SUPPLY MAIN WITH 38 MM (1½")DIA. P.E. SERIES 100 RECIRCULATION LINE INSIDE
P.E. HEATING CABLE CONDUIT BEDDED TO PIPE WITH HEAT TRANSFER CEMENT. INCLUDING AT ALL FIELD JOINTS
SIGNAL CABLE
600 MM. MINIMUM
300 MM
280 MM
100 MM
MIN.
150mm MIN.
280mm (11⅛")
150mm MIN
PIPE
13mm (½") INSULATION

TYPICAL SUPPLY LINE TRENCH DETAIL

heating cable conduit enclosed by the larger supply line. This is heat traced and insulated for freeze protection. Specifications are as follows:

Cable Conduit:

Type	Series 160 polyethylene pipe
Diameter	20 mm
Length	2900 m

Supply Line:

Type	Series 80 polyethylene Pipe DuPont Sclaircor
Diameter	150 mm
Length	2900 m
Insulation	Pre-insulated 10 cm polyurethane, c/w 45 mil Yellow Jacket

B.1.4 Treatment

The water is chlorinated by a Wallace and Tiernan Series A-747 hypochlorinator located in the distribution pumphouse. The hypochlorination facilities contain a 190 L polyethylene mixing tank. Since the water is of good quality, no additional treatment is required.

B.1.5 Storage

Presently under construction is a 179 m³ (52,500 Igal) storage tank located beside the central pumphouse and distribution facility.

It is constructed of 6.25 mm (1/4") steel on the sides and bottom. The coned top is constructed of 4.7 mm (3/16") steel. A 50 mm layer of insulation covers the storage tank.

B.1.6 Distribution Pumphouse

Two sets of pumps are used in this system. A submersible pump is located in the intake. The booster pumps are in the intake pumphouse. The fire pump, truck fill pump and circulating pumps are in the distribution pumphouse. Specifications are as follows:

Type	Jacuzzi Model 6S6X1 - S2 6" submersible turbine pump
Capacity	9.46 L/s @ 179 kPa TDH (125 IGPM @ 60' TDH)
Motor	5 HP, 230 V, single phase, 60 Hz, 3450 RPM

Booster Pumps - located in the intake pumphouse. Two are connected in parallel to pump the water to the central distribution pumphouse.

Type	Aurora 130 Series Close - Coupled Turbine Type Pumps
Capacity	0.88 L/s @ 313 kPa TDH (11.7 IGPM @ 105' TDH)
Motor	1.5 HP, 240 V, 3-phase, 60 Hz, 1750 RPM

Water circulating pumps - located in the central pumphouse to circulate water through the storage tank and piping in the building.

Type	Aurora 130 Series Close - Coupled Turbine Type Pumps
Capacity	0.88 L/s @ 418 kPa TDH (11.7 IGPM @ 140' TDH)
Motor	1.5 HP, 600 V, 3-phase, 60 Hz, 1750 RPM

Truck fill pump - located in the central pumphouse.

Type	Armstrong End Suction Motor Mount Centrifugal Pump
Capacity	12.6 L/s @ 45 kPa TDH (167 IGPM @ 15' TDH)
Motor	1.5 HP, 240 V, 3-phase, 60 Hz, 1750 RPM

Fire Pump - located in the central pumphouse. Provides reserve capacity to sustain fire flows in case of emergency.

Type	Paco Space - Miser, vertical in-line, single stage, centrifugal
Capacity	38 L/s @ 355 kPa TDH (500 IGPM @ 119' TDH)
Motor	30 HP, 600 V, 3-phase, 60 Hz, 1750 RPM

B.2 Water Distribution

B.2.1 Trucked System

Water is distributed by the local Council with two wheeled trucks. One truck has a capacity of 5683 L (1250 gal) and the other one with a capacity of 6819 L (1500 gal).

Water is delivered six days a week. Individual tanks are filled as needed.

The storage tanks in residences range from 455 L (100 Igal) to 2273 L (500 Igal). In the school, hostels, and nursing station, the tanks range from 4320 L to 45,500 L (10,000 Igal).

Average consumption is about 34 L/c/day (7.5 gal/c/day).

B.3 Sewage Collection

B.3.1 Sewage Pumpout and Truck Pick-Up

Most of the houses in the community are equipped with holding tanks. Those with pressure water systems have tanks for holding both toilet wastes plus sink and wash water. Those without pressure distribution systems have a holding tank for toilet wastes. The sewage collection contract is held by Settlement Council. Collection is carried out on a six day/week operating schedule by two 5455 L (1200 Igal) sewage tanker trucks. Service to each unit is one to six times a week depending on the number of occupants, building use and storage tank size.

B.3.2 Bagged Sewage Pick-Up

Bagged sewage is placed beside the garbage barrels and picked up three to four times a week along with the garbage.

B.4 Sewage Disposal

Presently sewage is discharged to the ground at the dump site located 1 km east of the settlement.

B.5 Solid Waste

B.5.1 Collection

Garbage is placed in 205 L (45 Igal) barrels outside homes and picked up three to four times a week by the local council workers.

B.5.2 Disposal

Garbage is presently deposited on the ice of 'Garbage Lake' in the winter and on its shore in the summer. This presents problems of containment, compacting, burning and covering. This lake is the same one that the sewage is disposed into.

B.6 Roads

The major routes through and around the community such as the airport road are in relatively good repair. They have a top width of 4 to 5 m and drainage is aided with ditches and culverts. Drifting snow creates problems for wheeled vehicles in the winter. There are some suitable sources of gravel in the area and aggregates have been manufactured by crushing rock from the bedrock ridges.

B.7 Surface Drainage

The drainage of the settlement is generally in three directions from a high point near the middle toward Cambridge Bay. Natural drainage conditions are relatively good because of the gravelly soils.

B.8 Fire Protection

Fire protection in Cambridge Bay consists of the following: - call boxes connected to an annunciator panel in a central building; - one Standard Triple Combination Pumper capable of pumping over 34 L/s (450 IGPM); it is a wheeled vehicle purchased in 1967; and - a 14 man volunteer fire brigade.

B.9 Other Services
Other services include twice a week mail service, a monthly newspaper, and radio and T.V. provided via the Anik satellite. Diesel operated power is provided by NCPC.

INFORMATION SOURCES

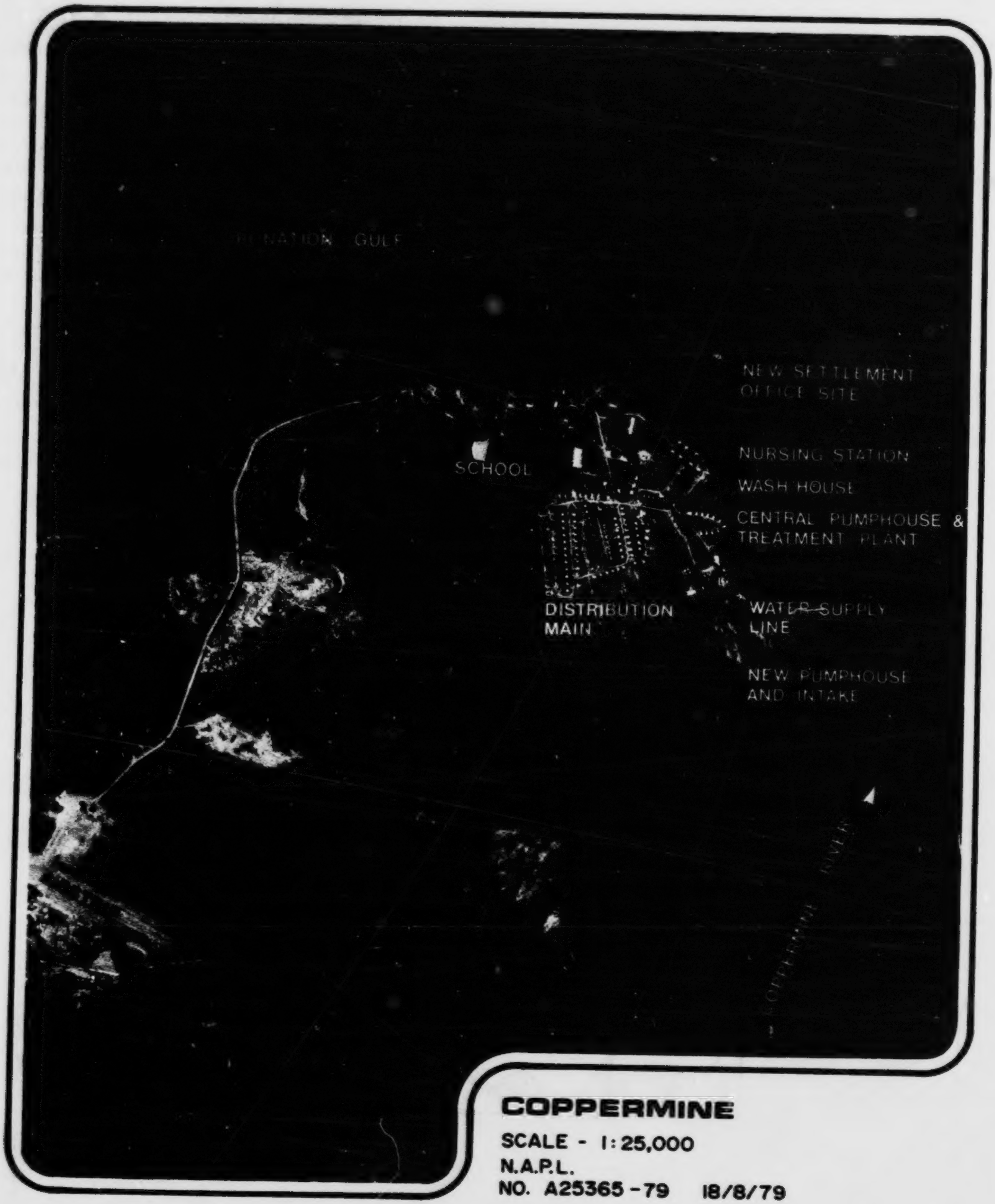
1. Underwood McLellan & Associates Ltd., *Cambridge Bay, N.W.T. General Development Plan,* February, 1977.

2. Underwood McLellan & Associates Ltd., *Cambridge Bay, N.W.T. Engineering Pre-design Report, Community Water and Sanitation Systems,* April, 1978.

3. Government of the Northwest Territories, Department of Public Works, Project: *Construction of a Water Intake Facility, Cambridge Bay, N.W.T.,* May, 1978.

4. Government of the Northwest Territories, Department of Public Works, Project: *Construction of Central Distribution Pumphouse and Water Supply Line, Cambridge Bay, N.W.T.,* May, 1979.

Coppermine


RONATION GULF
NEW SETTLEMENT OFFICE SITE
SCHOOL
NURSING STATION
WASH HOUSE
CENTRAL PUMPHOUSE & TREATMENT PLANT
DISTRIBUTION MAIN
WATER SUPPLY LINE
NEW PUMPHOUSE AND INTAKE
COPPERMINE RIVER

COPPERMINE

SCALE - 1:25,000
N.A.P.L.
NO. A25365-79 18/8/79

A. GENERAL

A.1 Location

Coppermine, immediately west of the mouth of the Coppermine river on Coronation Gulf, has the coordinates 67°50'N, 115°15'W. Buildings are spaced along the Arctic Coast for 1 km. The settlement extends inland to cover a rocky knoll. Coppermine is 563 air km by air north of Yellowknife.

A.2 History

In 1771, Samuel Hearne of the Hudson's Bay Company reached the mouth of the river he named Coppermine. He had been instructed to report on copper in the vicinity. The Inuit used it for knives, arrowheads and other implements and consequently they became known as the 'Copper Eskimos'.

A trapper and trader, Charles Klengenberg, set up a trading post at the site of the present community in 1916. The Inuit camped there on a semi-permanent basis to take advantage of the excellent fishing and sealing. In 1928, those few who had survived an epidemic at Bernard Harbour fled to Coppermine. An Anglican mission was built that year signalling the establishment of a permanent settlement.

A.3 Community Information

The settlement had a population of 761 in 1980. The number of residents has declined slightly over the past few years.

There is a considerable amount of employment through the Territorial Government, the Hudson's Bay Company, the settlement Council and the Co-Op for handicrafts and the distinctive soapstone carvings. Seasonally, income is derived from work with oil exploration companies, housing construction, and tourist lodges. Trapping, hunting and fishing contribute to the economy to varying degrees.

The settlement has a nursing station, a primary school, a community centre, a hotel, and recreation facilities.

Freight is brought in by barge via the Mackenzie river or by regular air service from Yellowknife. The gravel airstrip is 1524 m x 30 m at 22.5 m A.S.L.

A.4 Geology and Terrain

The site is underlain by precambrian sedimentary and volcanic rock. Dolomite and shale, interspersed with volcanic rock, form steep outcrops in the vicinity of the settlement. The buildings along the shore are perched on consolidated beach deposits. Directly behind this ridge is a low marshy area. The Inuit dwellings were constructed on granular material at a higher elevation back from the shore. There are numerous exposed rock surfaces in the community.

Coppermine is underlain by permafrost. The thickness of the active layer ranges from less than half a metre to over a metre in the sandy waterfront area.

Water delivery

A.5 Vegetation
Coppermine is within the arctic tundra zone. The ground is covered with grasses, sedges, heather, mosses and lichens. Willow and alder thickets are common in wet depressions.

A.6 Climate
Coppermine experiences winter for eights months of the year. The February mean daily maximum and minimum temperatures are -27°C and -35°C respectively. Mean daily maximum and minimum temperatures in July are 13°C and 5°C respectively.

The average annual total precipitation is 18.36 cm. Of this, about half falls as snow (80.2 cm).

Winds are from the north and east in the summer and from the south and west during the long winter. Wind speed generally remains steady at about 16 km/hr.

B. MUNICIPAL SERVICES

B.1 Water Supply
In 1980, the construction of a pumphouse and permanent intake structure into the Coppermine River replaced a portable pumphouse and hose. The water is pumped to a truck fill point. High water users are supplied by a small diameter pipe. The majority of homes have trucked water delivery.

B.1.2 Source
The Coppermine River, only 915 m from the center of the community is very turbid for a few weeks at spring breakup. For the greater part of the year, the water is of good quality except for a high iron content. The following 1977 chemical analysis was carried out for Underwood McLellan & Associates.

COPPERMINE RIVER CONSTITUENTS	(Sampled Sept. 28/1977)
(NOTE: All values in mg/L unless otherwise indicated)	
pH	7.65
Total Alkalinity as $CaCO_3$	23
Hardness (as $CaCO_3$)	45
Colour	10 Units
Turbidity	<1 JTU
Total dissolved solids	90
Total suspended solids	17
Calcium (Ca)	8.2
Iron (Fe)	0.8
Sulphate (SO_4)	2.5
Manganese (Mn)	5.7

B.1.3 Intake Facilities
The auxiliary pumphouse is a shed on skids housing one pump. In the winter, the sled may be pulled onto the ice and a 75 mm suction line is then dropped through a hole. Throughout the ice free months, the shed rests on shore and the intake line lies on the riverbed.

The pump capacity is 727 L/s @ 478 kPa (160 Igpm @ 160' TDH) driven by a 10 HP, 3500 RPM motor.

New dual intake pipes and a package pumphouse were installed in 1980.

The intake lines are 255 mm (10") Series 60 HDPE pipe insulated with polyurethene foam and heat-traced between the pumphouse and riverbed. The pipe is encased in a yellow jacket and a portion is enclosed in a 610 mm (24") corrugated metal pipe where exposed above grade or beneath rockfill at the riverbank.

The covering over the intake openings, located at a point where the river is 4 m deep, is a 610 mm (24") stainless steel box shaped screen with 0.05 mm (0.02") mesh. This screen is 7.5 m from shore and 0.6 m above the river bottom.

Two 10 HP submersible pumps inside the 255 mm intake lines discharge water through 75 mm Series 125 polyethylene lines to the pumphouse. The intake lines to the river are self-draining after each pumping cycle. Specifications are as follows:

Type:	Submersible turbine, 150 mm (6") in diameter
Number:	2
Model:	Jacuzzi Model I0S6H3
Capacity:	560 L/m @ 522 kPa (123 Igpm @ 175' TDH)
Motor:	10 HP, 3-phase, 600V, 60 cycle, 3450 RPM electric motor

The pumphouse contains the backwash piping and valves at the junction of the 75 mm discharge lines and the 100 mm supply line.

The supply utilidor to the reservoir pumphouse 400 m away is a 215 mm square metal box supported on steel pipe. The supply pipe and heating cable are surround by 50 mm of insulation.

B.1.4 Treatment
The water is chlorinated at the central pumphouse. No other treatment is provided.

B.1.5 Storage
The current storage facilities are comprised of two bolted steel tanks with a combined capacity of 409 150 L (90 000 Igal). The tanks are in the reservoir building.

B.2 Water Distribution
B.2.1 Piped System
Two oil fired boilers in the reservoir or treatment building raise the temperature to 20°C prior to distribution.

A 100 mm styrofoam insulated victaulic pipeline encased in a 0.3 m square metal utilidor delivers chlorinated water to the laundry and washhouse, nursing station, school and two residences. A 38 mm (1-1/2") pipe in the utilidor accommodates continuous recirculation of the water. The utilidor is not heat-traced. It is buried in a raised gravel pad

The school has a 45 460 L (10 000 Igal) tank and the nursing station tank holds 6820 L (1500 Igal).

B.2.2 Trucked System
The rest of the settlement is serviced by two water delivery trucks with 4090 L and 4550 L (900 Igal and 1000 Igal) capacity. The water is delivered two or three times per week under contract. In 1977, the Coppermine Eskimo Co-Op had the contract to deliver water to consumers. Most residences contain 1135 L (250 Igal) tanks. The Transport Canada trailer complex has a 9090 L (2000 Igal) tank.

B.3 Sewage Collection
B.3.1 Sewage Pumpout
All homes for government staff and institutional buildings have sewage pumpout tanks. They are pumped out three times per week except for the school's tank which is pumped five days per week. The wheeled vehicle used for this purpose has a 4550 L capacity. A small trailer mounted pumpout unit owned by N.C.P.C. provides pump-out services for the N.C.P.C. residences. The school and nursing station partially settle sewage in septic tanks. The effluent is then discharged to the holding tanks, respectively, 45 460 L and 6820 L in capacity. The contract for pumpout and disposal has been held by the Coppermine Eskimo Co-Op in recent years.

B.3.2 Truck Pick-Up
The rest of the community utilizes bagged sewage. Used bags are placed at the roadside in 205 L (45 Igal) barrels cut in half. The waste is picked up daily by a stake truck. The service has been provided by the Coppermine Eskimo Co-Op in recent years.

B.4 Sewage Disposal
The pumpout wastes and bagged sewage are dumped by the solid waste disposal area between the airstrip and Coronation Gulf.

B.5 Solid Waste Collection and Disposal
Domestic garbage is placed in 205 L (45 Igal) drums and left by the side of the road for pick-up by the stake truck three times weekly. Combustible waste is burned in the collection barrels to reduce volume.

B.6 Roads and Surface Drainage
Roads were built by placing fill material over the rocky terrain. A new sand pit has recently been developed adjacent to the airstrip. Granular fill is also available. The settlement is generally poorly drained. Spring runoff ponds in low spots and is augmented by kitchen wastes. Certain areas of the community may be considered semi-swamp.

B.7 Fire Protection
Coppermine has a 1970 wheeled triple combination pumper. Call boxes throughout the community are connected directly to a siren. About 14 volunteers are on standby to fight fires.

B.8 Other Services
C.N. Telecommunications operates a telephone and telex service. CBC Northern television is available via satellite. Mail is brought in by air daily. NCPC provides diesel generated power to the community.

INFORMATION SOURCES

1. Associated Engineering Services Ltd., *Solid Waste Disposal Study, Coppermine, N.W.T.*, 1979.

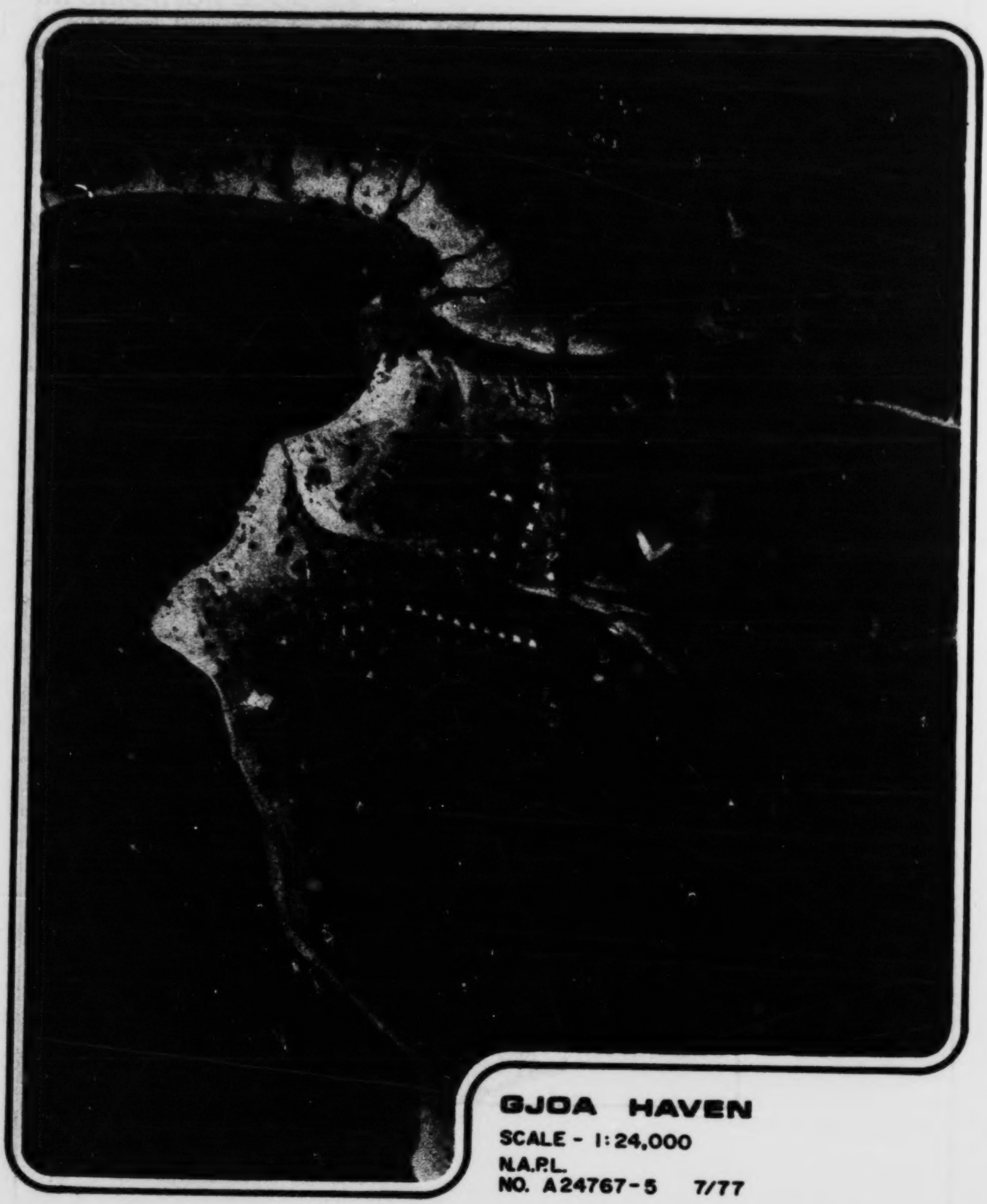
2. Underwood McLellan (1977) Ltd., *A Pre-design Report on Water Supply Pumphouse and Supply Line for Coppermine, N.W.T.*, July, 1978.

3. Underwood McLellan (1977) Ltd., *General Development Plan, Coppermine, N.W.T.*, June, 1979.

4. Underwood McLellan (1977) Ltd., *Coppermine N.W.T. Engineering Predesign Report, Community Water and Sanitation Systems*, Draft, May, 1978.

5. Department of Public Works, G.N.W.T., *Specifications for Water Supply Pumphouse and River Intake, Coppermine, N.W.T.*, March, 1980.

Gjoa Haven



GJOA HAVEN

SCALE - 1:24,000

N.A.P.L.
NO. A24767-5 7/77

A. GENERAL

A.1 Location

Gjoa Haven is located on the southeast coast of King William Island. Its geographical co-ordinates are 68°30'N latitude and 95°53'W longitude. It is located 140 km southwest of Spence Bay and 1056 km northeast of Yellowknife.

A.2 History

Roald Amundsen, the first person to navigate the Northwest Passage during 1903 to 1906, wintered in a natural harbour on King William Island. He named the harbour Gjoa Haven, after his ship the Gjoa. The Hudson's Bay Company opened their first post in this area in 1923, moving to the present site in 1927. Both the Anglican and Roman Catholic Churches established missions in the community which became a major settlement in the area.

A.3 Community Information

Gjoa Haven is classified as a settlement. In recent years the population has increased slightly. Estimates for the last three years are as follows:

POPULATION	YEAR
464	1978
493	1979
517	1980

Arts and crafts are a source of income for about 100 people. Wage employment in the construction industry is available during the summer for most people. During the winter social assistance is a major source of income. There is a 1200 m x 30 m gravel surface landing strip 1.5 km northeast of the community.

A.4 Geology and Terrain

Limestone bedrock, covered with a thin veneer of frost weathered in-situ sand and boulders, forms the characteristic terrain of the area. Bedrock predominates in the higher hills which rise up to 45 m. The surface in lower areas, especially near the core, is covered by a thick layer of fine sand and coarse rock.

Permafrost conditions underlay the entire area with the active layer ranging between 0.9 m to 1.2 m thick by the end of the summer.

A.5 Vegetation

Arctic tundra vegetation covers the area. Lichens grow on rock outcrops. Clusters of Arctic willows reaching a length of 0.5 - 1.0 m grow horizontally in well sheltered areas.

A.6 Climate

The July mean high and low temperatures are 24°C and 7.2°C respectively, while the January mean high and low temperatures are -23°C and -49°C. The average annual precipitation totals 83.8 mm. Snowfall averages 254 mm. There are light northerly prevailing winds.

Water Supply Lake

B. MUNICIPAL SERVICES

B.1 Water Supply

Water Supply Lake has been the source of domestic water supply for many years. Prior to the construction of intake facilities, untreated water was hauled directly from the lake and delivered by a 3410 L tank truck.

B.1.1 Source

Water Supply Lake is about 1 km northwest of the community. It is 11 m deep and has a capacity of 46 million L (10 million Igal) during the summer. Winter storage is about 23 million L (5 million Igal) under 2.5 m of ice.

Colour in the water exceeds recommended levels, but this does not constitute a health hazard. A chemical analysis report by W.L. Wardrop & Associates Ltd. of a sample taken in November, 1977 is as follows: (NOTE: All values in mg/L unless otherwise indicated)

Parameters	Values
pH	7.6
Total Hardness ($CaCO_3$)	146.3
Total Alkalinity (as $CaCO_3$)	117
Colour	5 Units
Turbidity	0 JTU
Calcium (Ca)	30.5
Chloride (C1)	9.6
Sulphate (SO_4)	3.3
Nitrate (NO_3)	0.13
Total Iron (Fe)	0.16

B.1.3 Intake Facilities

The present intake is located 9 m below the surface and extends 30 m out into the lake. Concrete ballast blocks placed at 1 m intervals keep the line in place. A mesh screen with 7 mm opening prevents large objects from entering the line.

The pipeline consists of two sections, an intake line up to the pump removal station and a supply line from the pump removal station to the storage building. Specifications for the pipes are as follows:

Intake Pipe:

Type: Series 45 HDPE Pipe
Diameter: 250 mm
Length: 37 m
Insulation: 45 mm polyurethane
Covering: 'Yellow Jacket' polyethylene outer-sheath 45 mil thick
Heating: Pyrotenax heat trace @ 16 watts/m

Supply Line:

Type: Series 80 HDPE Pipe
Diameter: 80 mm
Length: 198 m
Insulation: 45 mm polyurethane
Covering: 'Yellow Jacket' polyethylene outer-sheath 45 mil thick
Heating: Thermon Canada Econotrace @ 16 watts/m

B.1.4 Treatment

Treatment consists of a Wallace and Tiernan Model 745 hypochlorinator complete with a 136 L (30 Igal) feed tank. It is located in the water storage building.

B.1.5 Storage

Storage facilities at the end of the pipeline consist of one 11 365 L (2500 Igal) storage tank. The tank is located inside a building to prevent the water from freezing. It is constructed of mild steel.

B.1.6 Pumping Facilities

There are two sets of pumps in this system. The first is located in the intake and pumps the water to the storage tank. The second pumps water from the tank to the delivery truck. Specifications are as follows:

Intake Pump

Type: 100 mm Submersible
Model: Jacuzzi Model 254X8
Capacity: 136 L/m @ 418 kPa (30 Igpm @ 140') TDH
Motor: 2 HP, 3-phase, 208V

Truck Fill Pumps (Two pumps - one standby)

Type: In-Line
Model: Bell & Gossett Model 60-20T
Capacity: 455 L/m @ 84 kPa (100 Igpm @ 28') TDH
Motor: 2 HP, 3-phase, 208V

B.2 Water Distribution

The water delivery contract is held by the local Council, using a 4546 L (1000 Igal) delivery truck.

B.3 Sewage Collection

The local Council holds the contract for sewage and garbage collection. A wheeled truck provides pump-out service. Old fuel drums without tops in front of each house are used for the collecton of domestic waste. Bagged sewage placed in these barrels is collected every two days by the local Council. A stake truck is used to collect bagged sewage and garbage.

B.4 Sewage Disposal

Use of the present disposal site commenced in 1975. It is about 1.5 km north of the community. Access to the site is by an extension of the gravel road leading to the water storage terminal. Although the site is poorly graded, it drains to the northeast away from the settlement, thereby minimizing pollution concerns.

Liquid sewage is pumped into a pond at the disposal site. The pond holds the waste during the winter period and acts as a lagoon during the summer.
A new runway for the community is planned. This would require the relocation of the present disposal area access road. Because of this, and recommendations to establish a new solid waste disposal area east of the settlement, other areas for sewage disposal are being studied.

B.5 Solid Waste

Solid waste is collected by the local Council along with the bagged sewage.

Householders burn dry garbage in the collection barrels in order to reduce the volume and to reduce the amount of windblown material. Most domestic garbage is dumped at the same disposal site as the sewage. There is insufficient cover material nearby to adequately cover the garbage.

Some old metal building components are stored to the east of the community.

B.6 Roads

Granular material suitable for road construction is available nearby. At least two main roadways have been improved by the addition of gravel fill. They are the airport road, and the Water Lake garbage disposal access roads. The rest are basically trails through the existing sand surface.

B.7 Surface Drainage

There are major drainage courses within the settlement area. Because of the sandy soil and natural slope of the site, the local drainage is towards the main channels or direct to the sea, and is generally adequate. Houses constructed on course gravel pads do not disrupt the drainage pattern because of the permeability of the sand.

B.8 Fire Protection

Fire protection in Gjoa Haven consists of the following:

- call boxes connected to an annunciator panel in a central building;
- a mini-pumper capable of pumping 11 - 34 L/s (150 - 450 IGPM); and
- 10 man volunteer fire department.

B.9 Other Services

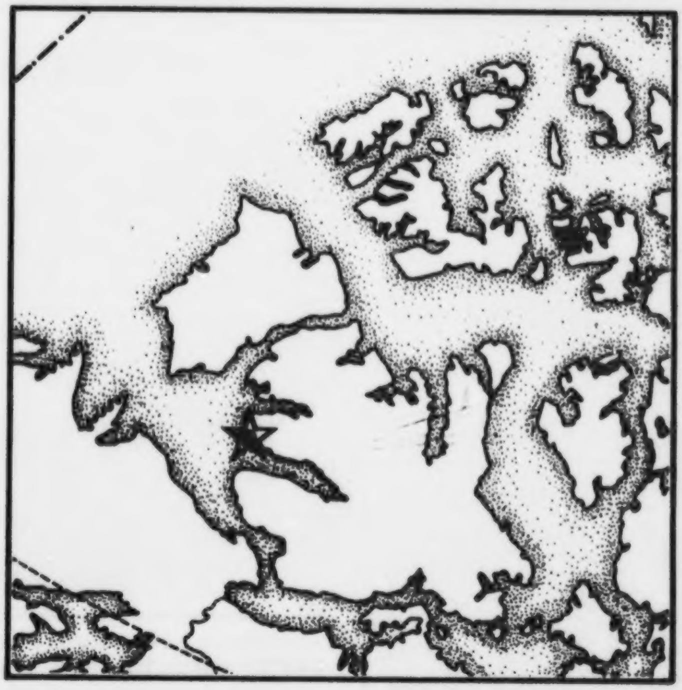
Other services include mail service three times a week, a primary school and a community centre. There is no radio, television or local newspaper. NCPC provides diesel generated electric power to the community.

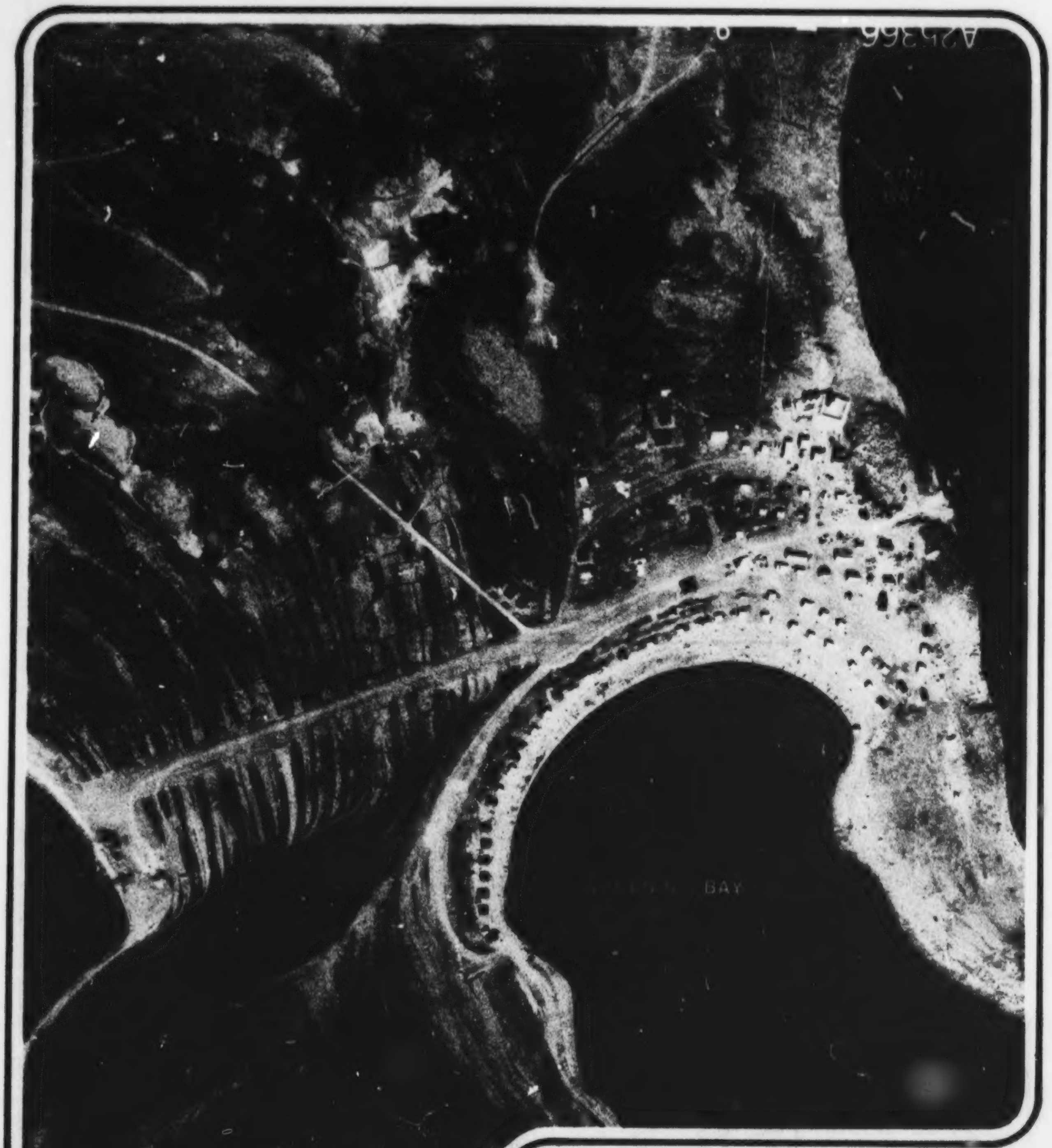
INFORMATION SOURCES

1. Underwood McLellan & Associates Ltd., *Gjoa Haven General Development Plan*, April, 1976.

2. Government of the Northwest Territories, Department of Public Works, *Project: Water Supply Facilities, Gjoa Haven, N.W.T.*, April, 1978.

Holman Island





HOLMAN ISLAND

SCALE - 1:7,500
N.A.P.L.
NO. A25366-9 19/8/79

A. GENERAL

A.1 Location

The settlement of Holman Island is located on the shores of King's Bay and Queen's Bay on the western side of Victoria Island. The geographical co-ordinates are 70°43'N latitude and 117°45'W longitude. It is 925 km north of Yellowknife, 507 km northwest of Cambridge Bay and 322 km north of Coppermine.

A.2 History

The Hudson's Bay Company established a trading post 29 km from the present community site in 1923. A Roman Catholic mission was built beside the post in 1939 and Inuit families gravitated to the area to settle. Due to a lack of room for expansion, the community was moved to its present location in 1964. The first school was erected in 1965.

A.3 Community Information

In April of 1980 the population breakdown was 358 and has been gradually increasing. The government statistics section projected a growth rate of 3.14% per year. The community has settlement status.

A large segment of the employable persons are engaged in the handicraft industry. Others work for the Territorial or Federal Government. Hunting, fishing and trapping occupies over one fifth of the men. Fox hunting and sealing are particularly significant to the Inuits' livelihood.

Community services are sparse. Four religious denominations are represented, a nursing station is staffed with two nurses, and the local elementary school has an enrollment of about 90 students. There is a new community centre, a Co-Op store and N.W.T. Public Library service.

Access to Holman Island from the south is by N.T.C.L. barge in August and September and by twice weekly flights from Yellowknife. The airstrip is 1311 m x 30.5 m at 35.7 m A.S.L.

A.4 Geology and Terrain

The settlement occupies a series of raised gravel beaches. This clean flat gravel is stable and free-draining.

The underlying bedrock consists of basalt flows intruded by diabasic gabbro sills and dikes. Escarpments and outcrops of gabbro dominate the terrain.

Although most of the region is covered with boulders from the talus slopes, there are surficial soils immediately to the west of the community where the land is flat and low lying. These are comprised of fine sand, silt, clay and gravel.

The active layer in this portion of the continuous permafrost zone is 0.6 m thick in dry gravel and 0.9 m deep in other areas.

A.5 Vegetation

Holman Island is well within the Arctic Circle and hence has limited vegetal cover. Vegetation varies from lichens and coarse grasses to stunted shrubs.

A.6 Climate

Holman has a dry, cold climate with steady east winds. The sea ice breaks up in early July and freeze-up occurs in early October. The mean daily temperature in February is -31°C and the mean daily temperature in July is -8°C.

Approximately 77 mm of rainfall each year on average. Mean annual snowfall is 853 mm.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Sources

Water is trucked from two sources - RCAF Lake located about 2.1 km northeast of the community and Ukpillik River. Lake water is trucked from freeze-up until the spring thaw. River water is distributed during the summer months.

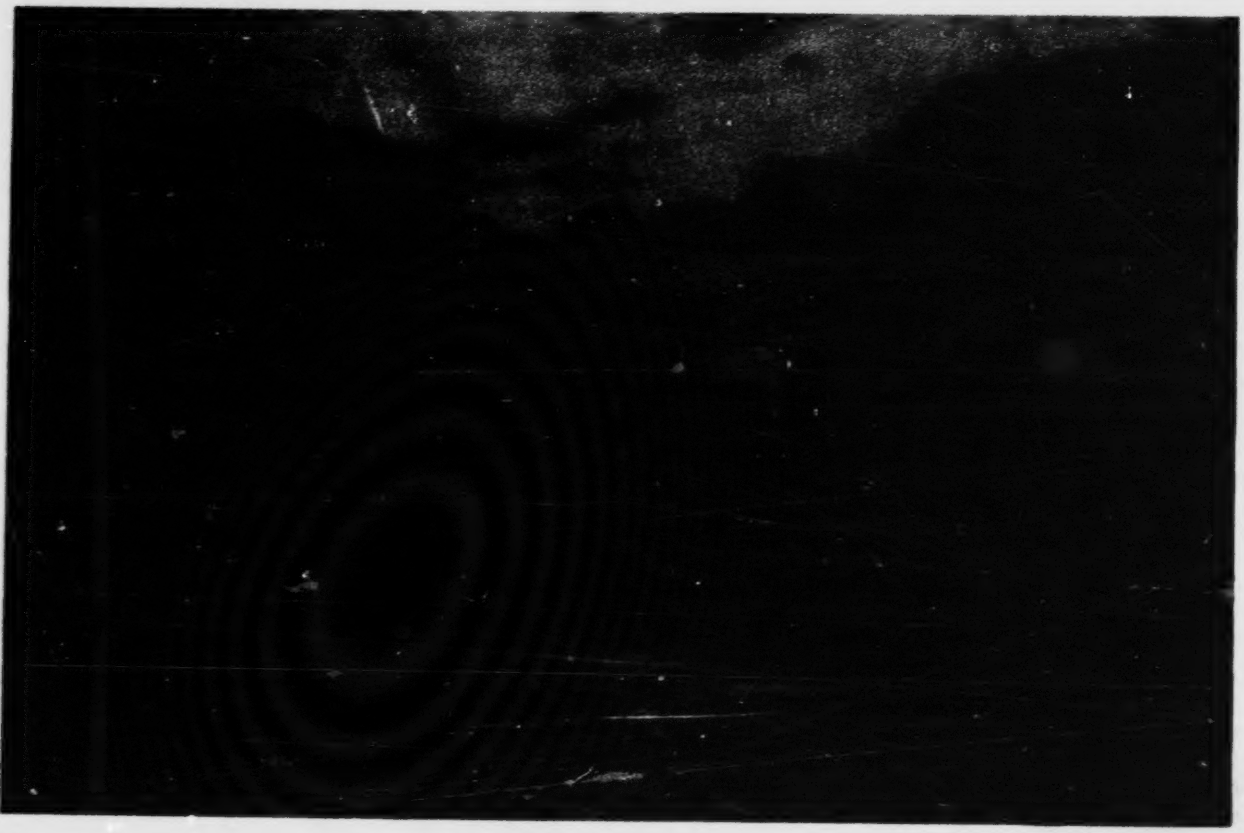
RCAF Lake has been used as a potable water supply for many years. It is connected to the settlement by a 2.1 km road. The lake has an area of 45.5 ha, a maximum depth of 9.1 m and a volume in the order of 4.1 x 10^6 m^3. This volume is considered to be 25 times more than adequate to meet a year 2010 water demand.

According to a recent chemical analysis, the water is soft and of good quality. (All constituents in mg/L unless otherwise noted)

CONSTITUENTS	RCAF LAKE	UKPILLUK RIVER
pH	7.72	8.01
Bicarbonate (as CO_3)	23	49
Total alkalinity (as CO_3)	23	49
Calcium (Ca)	9	20
Magnesium (Mg)	4	11
Total Hardness (as $CaCO_3$)	39	95
Colour (units)	8	8
Iron (Fe)	0.05	0.05
Turbidity (JTU)	1	1
Total Dissolved Solids (dried at 105°C)	73	148
Suspended Solids (Total)	2	2

(Samples were taken July 3, 1979. Analyzed by Western Industrial Laboratories Ltd., Edmonton for Associated Engineering Services Ltd.)

Ukpilluk Lake, the source of Ukpilluk River, has an annual recharge of 7 x 10^6 m^3. Samples from the river indicate the water is hard but all constituents are within acceptable limits. The point at which the water truck is filled is 2.0 km from Holman via the Airport Road.



Garbage and sewage bag collection

Sewage pumpout facility

B.2 Water Distribution

A pump on the water truck draws water through a length of suction hose laid on the bed of the lake or river in summer.

In winter a hole is chopped in the lake ice by hand a few metres offshore and the hose is lowered into the water.

The water truck holds 5450 L (1200 Igal). Untreated water is delivered to each home. The average community water use is estimated at 29 Lpcd.

The water delivery contract has been held by the local Eskimo Co-Op in recent years.

B.3 Sewage Collection

In 1979 about 23% of the population lived in the 17 dwellings with plumbing and sewage pumpout tanks. The remaining 77% have no plumbing and use honeybags.

A tractor pulls a sewage pumpout tank on a trailer around to the serviced homes once a week. It is operated by the Holman Eskimo Co-Op. The contract for bagged sewage collection is also held by the Eskimo Co-Op.

A trailer pulled by the tractor is used for this purpose.

B.4 Solid Waste Collection

Garbage is placed in old fuel drums and burned to reduce volume. The drums are collected and taken to the dump by the Eskimo Co-Op under contract. Upon being emptied, drums are returned to each house. Garbage is normally picked up once per week.

B.5 Sewage and Solid Waste Disposal

The waste disposal site is situated north of the airport road in a soil characterized by fine sand, clay and some gravel. The water table is very high and the shallow pits dug for separate liquid sewage, bagged sewage and solid waste disposal are partially filled with water in the summer.

B.6 Roads and Surface Drainage

Most of the buildings were erected on the gravel terraces and hence are well drained. Permafrost prevents subsurface drainage and causes waterlogging in the flat areas.

Conventional roads are not necessary due to the lack of vehicular traffic. The tracks are covered with a layer of gravel.

B.7 Fire Protection

Fire alarms are mounted on street light poles. A wheeled extinguisher and 10 volunteers form the fire brigade.

B.8 Other Services

Mail is brought into Holman twice weekly. There is telephone service and television is expected to be available in the near future. NCPC provides diesel generated power.

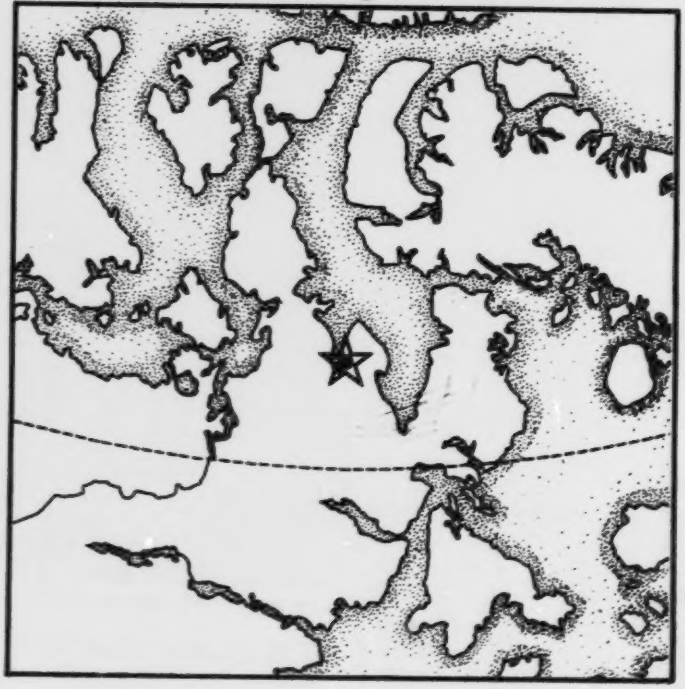
INFORMATION SOURCES

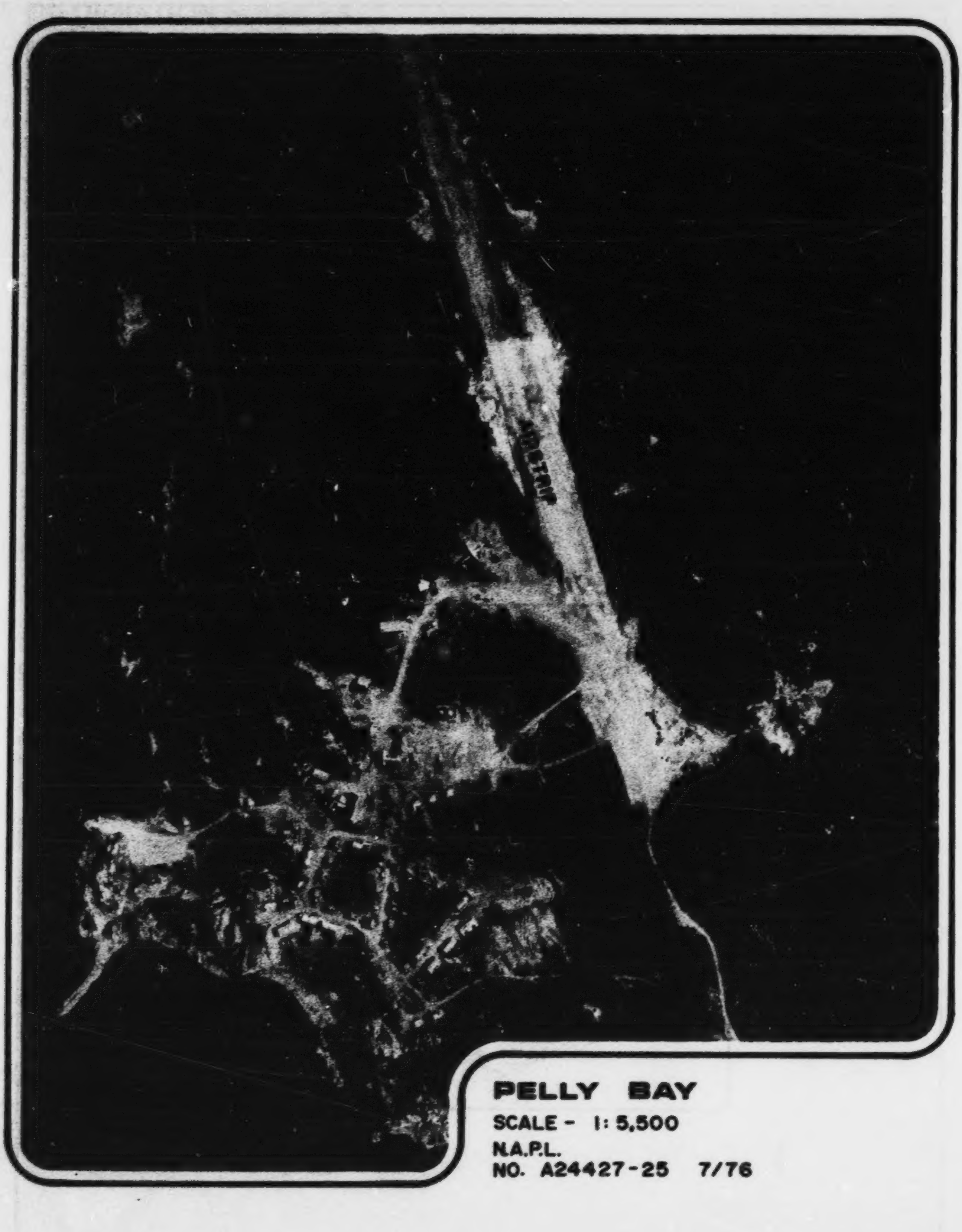
1. Haddin, Davis & Brown Co. Limited, Consulting Engineers, *Department of Northern Affairs and National Resources, Northern Administration Branch, Report on Holman Settlement, N.W.T.,* December, 1963.

2. Underwood McLellan (1977) Ltd., Consulting Engineers and Planners, *Development Plan, Holman Island, N.W.T.,* Edmonton, February, 1978.

3. Associated Engineering Services Ltd., *Water Supply and Sewage,* Draft of Pre-design Report, Edmonton, July, 1980.

Pelly Bay





PELLY BAY

SCALE - 1: 5,500

N.A.P.L.
NO. A24427-25 7/76

Winter scene in community

A. GENERAL

A.1 Location

The Inuit community of Pelly Bay is situated to the south of the Kukadjuk River on Pelly Bay. It is on the northeastern mainland of the Keewatin District. The co-ordinates are 68°32'N latitude and 89°48'W longitude. Pelly Bay is 1310 km northeast of Yellowknife, 177 km southeast of Spence Bay and 625 km east of Cambridge Bay.

A.2 History

Inuit used the site as a fishing camp for years before the Roman Catholic mission was built in 1935. Since that year the indigenous people have slowly congregated to form a permanent settlement. With the construction of a school, store, and better housing in the mid 1960's, growth accelerated and the settlement achieved Hamlet status in 1973.

A.3 Community Information

There were 270 permanent residents of Pelly Bay in 1980. The population has remained fairly stable over the past few years. It is about 96% Inuit.

The economy is based on craft production, hunting, and intermittent commercial fishing. An elementary school with library, nursing station and Co-Op store provide further employment. These assets are augmented by a community centre which doubles as a church. There are few recreation facilities.

All freight must be flown in as ice in the bay causes barge traffic problems. Regularly scheduled planes fly in from Cambridge Bay. The gravel airstrip is 1074 m x 33.5 m at 89.6 m A.S.L.

A.4 Geology and Terrain

The surrounding terrain has huge outcrops of Precambrian rock interspersed with plains of till. The buildings were erected on one of the flat till plains. Shallow lakes in the vicinity form constraints to development. Pelly Bay is underlain by continuous permafrost.

A.5 Vegetation

The rock and till are sparsely covered with mosses and lichens indigenous to the barren lands.

A.6 Climate

Pelly Bay experiences freeze-up in October and break-up of the sea-ice in late June. The coldest month, January, has a mean daily temperature of -33°C. July has a mean daily temperature of 7°C. Rainfall amounts to 10.4 cm per year on the average while 87.4 cm of snowfall accummulates during the rest of the year. Wind gusts up to 134 km per hour can be experienced in Pelly Bay.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Sources

Water is currently trucked from three sources. A stream 2.4 km south of the Hamlet is the summer supply, a lake at the far end of the airstrip is used during the early winter until the water becomes turbid due to drawing of water from the bottom as the ice thickens. Another lake further away is used for the remainder of the season.

The DIAND took water samples in July of 1977 from the river and the lake closest to the Hamlet and are shown as follows: (All values in mg/L unless otherwise noted)

Parameter	River	Lake
pH	7.6	7.2
Specific Conductance	87.7	37.4 umho/cm
Turbidity	3.0	2.5 JTU
Colour	5.0	10.0 units
Calcium (Ca)	13.4	3.3
Hardness (as $CaCO_3$)	42.5	11.4
Alkalinity (as $CaCO_3$)	37.3	7.1
Sodium (Na)	2.0	1.0
Potassium (k)	0.3	0.3
Sulphate (SO_4)	11.0	3.2

B.1.2 Water Distribution

Deliveries are made in a 4550 L (1000 Igal) wheeled tank truck new in 1978. The newer homes have 1135 L (250 Igal) tanks and plumbing fixtures. The majority of dwellings have 205 L (45 Igal) containers for water storage.

Water is batch chlorinated in the tank truck although it is infrequent. No other treatment is provided.

B.3 Sewage Collection

Those residents fortunate enough to have plumbing facilities have sewage pumpout tanks. The rest of the community is served by bagged sewage which is collected by the garbage truck.

B.4 Solid Waste Collection

Combustible materials are burned in front of homes. Any other wastes are hauled to the dump about three times per week.

B.5 Sewage and Solid Waste Disposal

The Koomuit Co-Op had the contract for 1977-1978 to collect garbage and sanitary wastes.

The garbage dump is less than 2 km from the Hamlet.

B.6 Roads and Drainage

Due to the lack of vehicular traffic, the gravel roads have not been developed to any great extent.

Drainage within the Hamlet is poor. Domestic waste water renders the roads muddy as there are no drainage channels.

B.7 Fire Protection

Volunteers equipped with a small wheeled tank and pump constitute Pelly Bay's fire brigade.

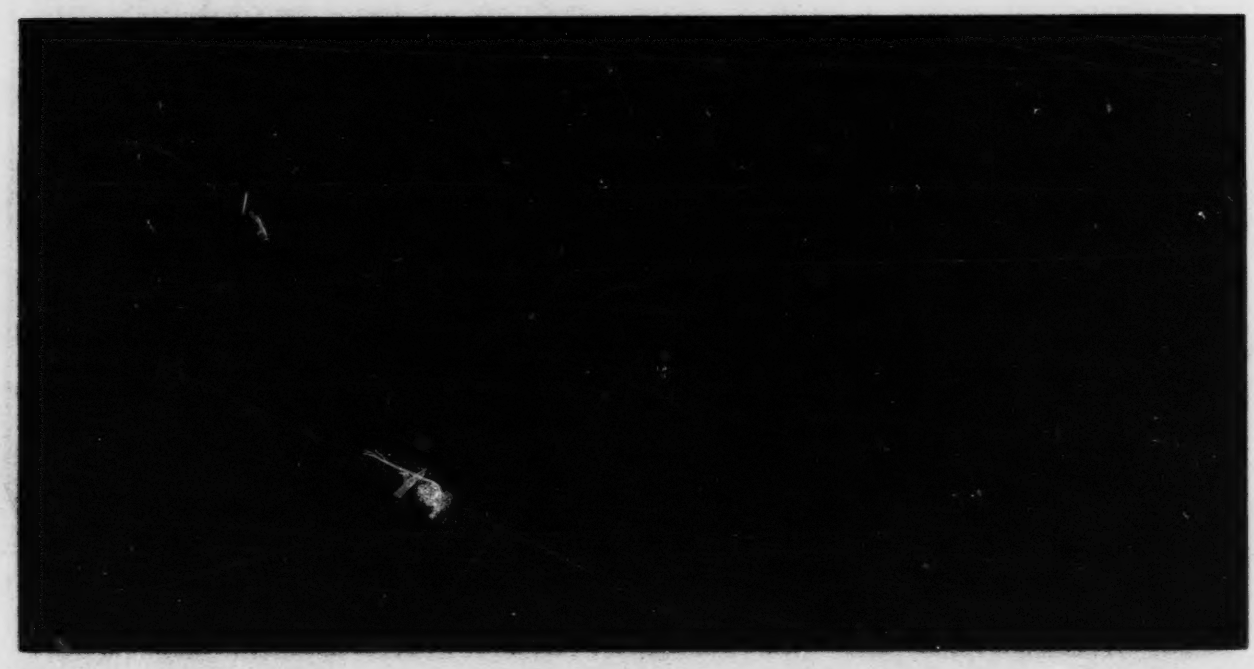
B.8 Other Services

Pelly Bay has mail service twice weekly, has a local radio station, receives CBC northern radio and television, and has telephone service. NCPC provides diesel generated power.

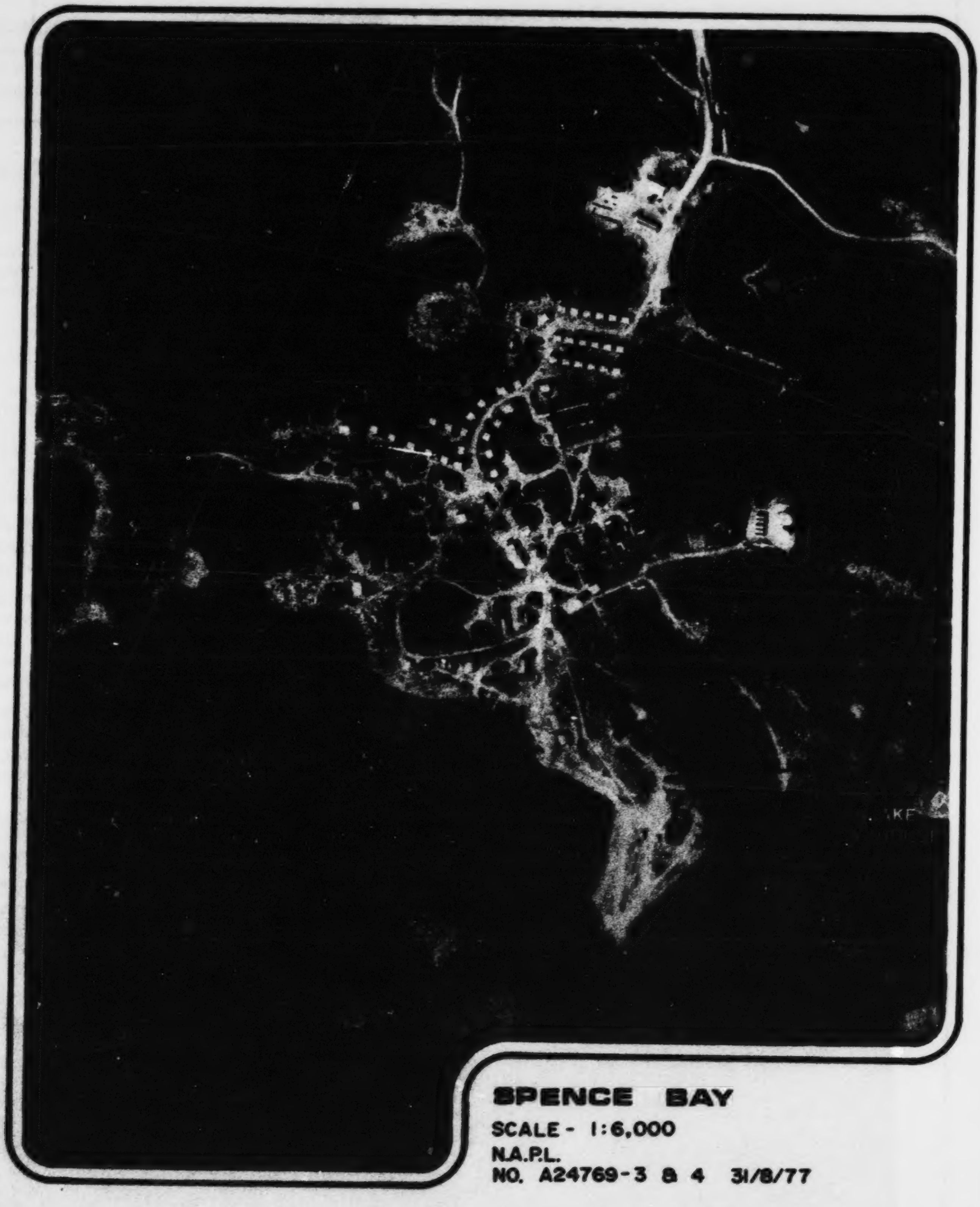
INFORMATION SOURCES

1. Underwood Mclellan & Associates Ltd., *Planning Study Report for Pelly Bay, N.W.T.*, September, 1967.

2. Department of Public Works, Government of the Northwest Territories, Project Management Division, *Pelly Bay Water and Sewage Pre-design Report*, 1978.



Spence Bay



SPENCE BAY

SCALE - 1:6,000

N.A.P.L.

NO. A24769-3 & 4 31/8/77

Winter scene

A. GENERAL

A.1 Location

Spence Bay is located on the west coast of Boothia Peninsula, 460 km east of Cambridge Bay and 1224 km northeast of Yellowknife. The settlement is situated in a narrow inlet projecting northeastward from the head of Spence Bay. The western side of the inlet consists of cliffs rising to 23 m, with a point of land projecting half-way across the inlet forming an inner and outer harbour. The eastern side is generally rocky with cliffs rising to 14 m. The community is located at a latitude of 60°32'N and a longitude of 93°32'W.

A.2 History

Boothia Peninsula received its name from John Ross. His 1829 expedition was funded by Felix Booth, a London gin distiller. In 1904 Amundsen, on his voyage through the Northwest Passage, explored much of the west coast of Boothia Peninsula. In 1947 Fort Ross, located on Somerset Island, was closed because ice rendered it too difficult for access; its inhabitants then moved to Spence Bay.

A.3 Community Information

Spence Bay is classified as a settlement. Between 1978 and 1980 the population increased slightly from 454 to 465. The economic base of the community is primarily dependent on crafts and carving. Hunting, trapping and fishing also take place.

The aerodome has two gravel surfaced runways which are located north of the community. One runway is 914 m x 30 m and the other is 853 m x 23 m with both located at an elevation of 26 m.

A.4 Geology and Terrain

The community is situated on boulder glacial till underlain by precambrian granites and gneisses with palaeozoic limestone. The beach material in the area has a very coarse composition and is generally not suitable for construction purposes.

There is an esker composed of sandy gravel located a short distance west along the north shore of Spence Bay. Depth to permafrost varies between 46 cm to 94 cm.

A.5 Vegetation

There is little vegetation in the area excepting lichens, mosses, and willow mats. Water loving grasses and sedge grow in the more poorly drained depressions.

A.6 Climate

The temperatures in Spence Bay are as follows: The July mean high and low are 12°C and 3°C respectively, and the January mean high and low are -30°C and -38°C. Precipitation consists of 71.6 mm rainfall and 1191.26 mm of snow. South winds are most common with northeast and northwest following closely behind.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Source

The present source of potable water is Water Supply Lake situated immediately northeast of the community. It is of acceptable quality for drinking standards. A typical chemical analysis is as follows: (NOTE: All values in mg/L unless otherwise indicated)

CONSTITUENTS

pH	6.8
Turbidity	8.6 NTU
Phosphate (total P)	< 0.05
Nitrogen (nitrate)	0.022
Total Hardness (as $CaCO_3$)	78.6
Total alkalinity (as $CaCO_3$)	86
Total suspended solids	5.0
Fluoride (F)	0.1
Cadmium (Cd)	0.011
Iron (Fe)	1.96
Mercury (Hg)	< 0.02

(Sampled by Government of the N.W.T.)

The lake is approximately 13.7 m deep, with a useful storage capacity beneath the ice of about 3.4×10^9 L.

B.1.2 Intake Facilities

The intake system extends out into Water Supply Lake. A wet well is located in approximately 2.5 m of water. A pumphouse is situated on a small causeway into the lake.

Wet well dimensions:	457 mm x 2896 mm deep
Construction:	16 gauge galvanized sheet metal corrugated culvert
Insulation:	50 mm rigid polyurethane foam, c/w polyethylene jacket

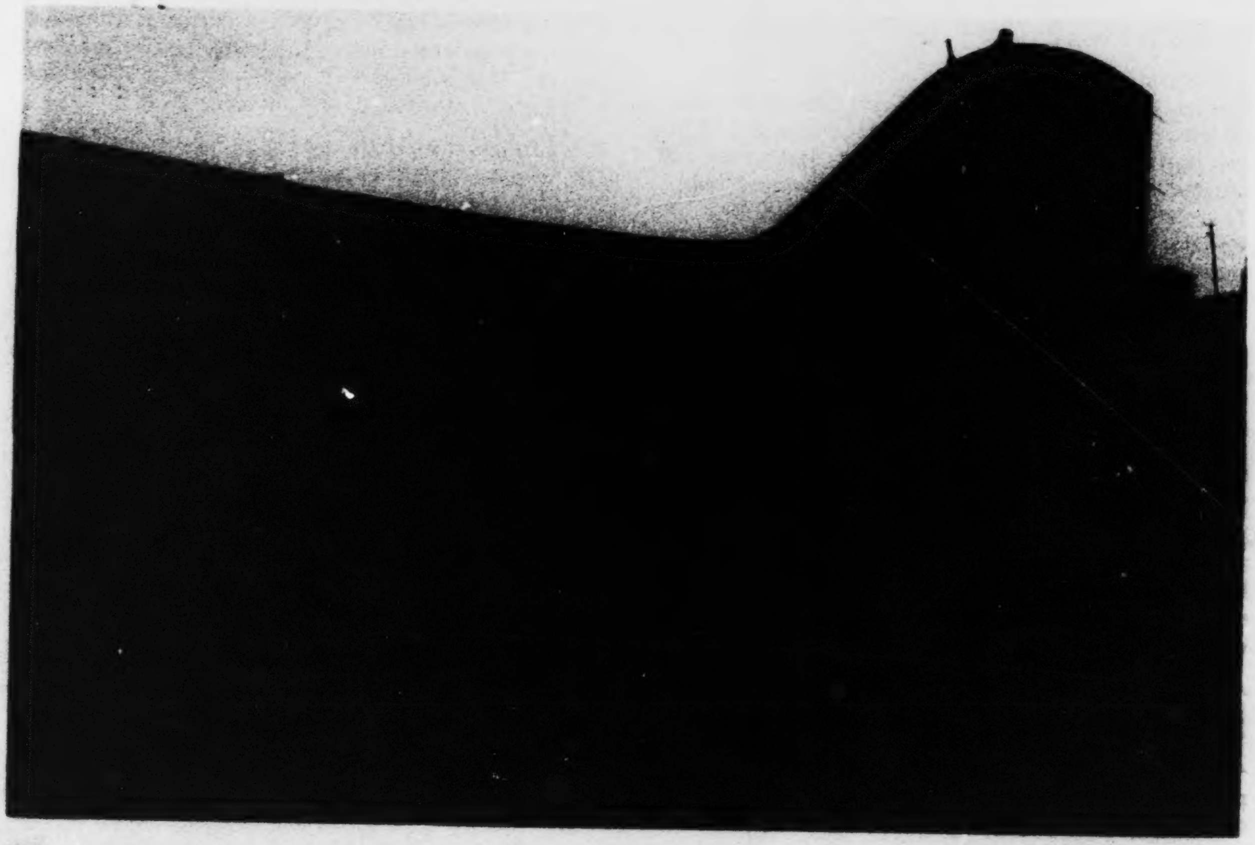
An intake screen of galvanized steel metal mesh prevents objects from entering.

A utilidor extends from the intake well to the truck distribution centre. The nursing station is serviced directly off this utilidor. Specifications for the utilidor are as follows:

Length:	868 m (2850′)
Construction:	18 gauge galvanized sheet metal covering
Insulation:	5 cm urethane foam on the inside of utilidor plus insulation around pipes
Pipe:	supply - 5 cm diameter hard copper

The supply line lies above the return line and both are wrapped with heat-trace cable to prevent freezing. Both are also surrounded with pre-fabricated solid insulation in a galvanized steel utilidor.

Water is heated at the truck fill station through boiler/heat exchanger before being returned.



B.1.3 Treatment

A Wallace and Tiernan Series A-588 with a 114 L (30 Igal) polyethylene chemical solution mixing tank provides chlorination at the truck fill point.

B.1.4 Storage

A 45,460 L (10,000 Igal) storage tank is located in the truck distribution building. The building is heated in the winter which keeps the storage tank thawed.

B.1.5 Pumping Facilities

There are three pumps in this water supply system. One is located in the intake pumphouse to pump water to the storage tank. The other two are located in the truck distribution house in the storage tank. They transfer water from the storage tank to the truck.

Intake Pump (1)

Capacity: 75 L/min @ 322 m (17 Igpm @ 105') TDH
Motor: 3/4 HP, 1-phase, 230V, 60 cycle, 3450 RPM electric motor

Transfer Pump (2)

Capacity: 227 L/min @ 6 m (50 Igpm @ 20') TDH
Motor: 1-1/2 HP, 1-phase, 220V @ 3450 RPM

Only one of the pumps in the storage tank is ordinarily required. The other one is for back-up and to increase the flow during fire situations.

B.2 Water Distribution

B.2.1 Piped System

Water is supplied to the nursing station directly from the utilidor, since it is situated beside the main utilidor. This water is not chlorinated. The rest of the community is served by trucked delivery. The station is situated at the high point of the pipe. The pipe passes through the station at this point and fills a tank in the crawl space. Air vents in the line assure that no air hinders flow at this high point.

B.2.2 Trucked System

A trucked water distribution system serves the rest of the community. During the past few years the Paleajook Eskimo Co-Op has handled distribution. One water truck adequately serves the community.

B.3 Sewage Collection and Disposal

Pumpout is also handled by the Paleajook Eskimo Co-Op. The majority of the residences are on a bagged sewage system consisting of daily pick-up of the plastic bags. Greywater is disposed of onto the ground adjacent to the residence. Sewage disposal is at the dump located 1.5 km northwest of the settlement, near the airport. Both holding tank effluent and bagged sewage is deposited here. Surface drainage from the garbage dump flows through two small fresh water ponds into the ocean.

B.4 Solid Waste

Garbage is collected once a week, by the Paleajook Eskimo Co-Op. Solid wastes are deposited at the same site northwest of the community used for sewage disposal.

B.5 Roads and Drainage

Roads are gravel surfaced throughout the community and drainage is over land towards Spence Bay Inlet. Drainage is generally poor and greywater deposited onto the ground from residences tends to puddle and create nuisance problems.

B.6 Fire Protection

Fire protection in Spence Bay consists of the following: - one centrally located siren and 17 call stations - one 1969 trucked mini-pumper capable of pumping 11 - 34 L/s (150-450 Igpm); and - a 10 man volunteer fire brigade.

B.7 Other Services

Other services include telephone service by Northwest Tel and mail service four times per week. There is no television, radio or local newspaper. NCPC provides diesel generated power for the community.

INFORMATION SOURCES

1. W.L. Wardrop & Associates Ltd., *Pre-design Report, Sewage Disposal System, Spence Bay, N.W.T.*, January, 1979.

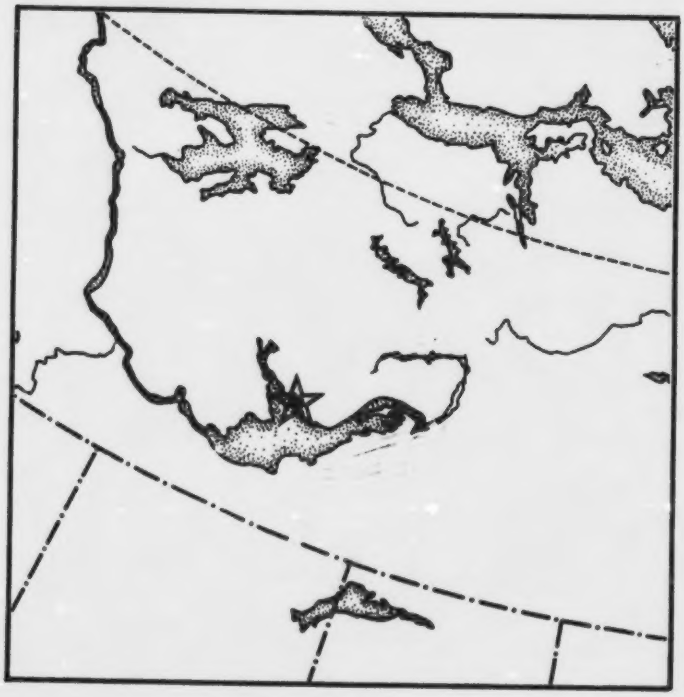
2. Department of Mines and Technical Surveys, *Terrain and Site Analysis, Spence Bay, N.W.T.*, May, 1962.

3. Government of the Northwest Territories, Department of Public Works, *Project: Sewage Disposal System, Spence Bay, N.W.T.*, June 1979.

4. Government of the Northwest Territories, Department of Public Works, *Project: Construction of Water Supply System at Spence Bay, N.W.T.*, March, 1974.

FORT SMITH REGION

Detah



DETAH

SCALE - 1:5000
N.A.P.L.
NO. A25767 - 105

Aerial view

A. GENERAL

Detah is located on the east shore of Yellowknife Bay, approximately 27 km by gravel road or 6.5 km by ice road or water from Yellowknife. Its geographical co-ordinates are 62°24′N and 114°20′W.

Detah is populated by members of the Yellowknife band of Dogrib Indians who moved to the settlement from the east shore of Great Slave Lake. Latham Island Indians moved to the settlement when Yellowknife started to grow.

The community is classified as unorganized. A three room school containing Kingergarten - Grade 3 is situated here. Other students are bussed daily to schools in Yellowknife. Medical care and other services are obtained in Yellowknife. The population has remained fairly constant over the past three years at approximately 160 people.

Detah is built on a rocky outcrop by the shore of Great Slave Lake. The soils consist of fine grained silt and clay overlaying a granitic intrusive bedrock. The community is situated in a region of discontinuous permafrost.

Vegetation in the area consists of muskeg or of stunted coniferous and deciduous trees typical of the Boreal Forest zone. Shrubs, grasses and mosses also abound.

The mean July high and low temperatures are 20°C and 11°C respectively. The January high and low temperatures are -23°C and -32°C. Rainfall amounts to 143.5 mm and snowfall to 1100 mm.

B. MUNICIPAL SERVICES

B.1 Water Supply

Although water is trucked from Yellowknife once per week by Peter Pagonis, many residents still take water directly from Yellowknife Bay.

B.2 Sewage Collection

Jonas Sangris, a resident of Detah, has had the contract for collection of sewage bags over the past years.

B.3 Sewage and Solid Waste Disposal

The waste is deposited in a dump adjacent to the access road 1.2 km north of the settlement. A narrow trench was dug in the sand for bagged sewage wastes. Garbage is heaped in a pile at right angles to the pit.

B.4 Roads and Drainage

Poor gravel roads wind between the homes scattered haphazardly over the rock. There is no organized drainage system. Domestic waste water and precipitation follows the slope of the rock to the lake, or pools in depressions.

Fire protection

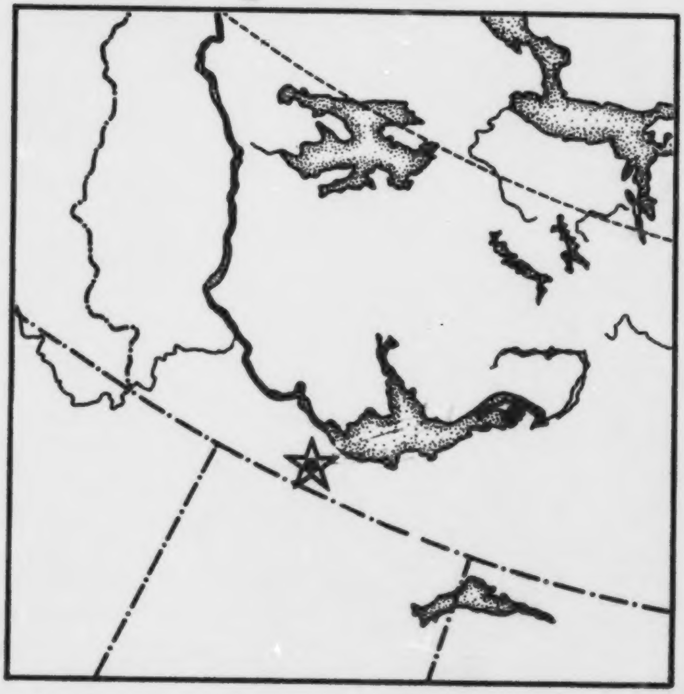
B.5 Fire Protection
Fire protection equipment consists of a large fire extinguisher on wheels and a siren.

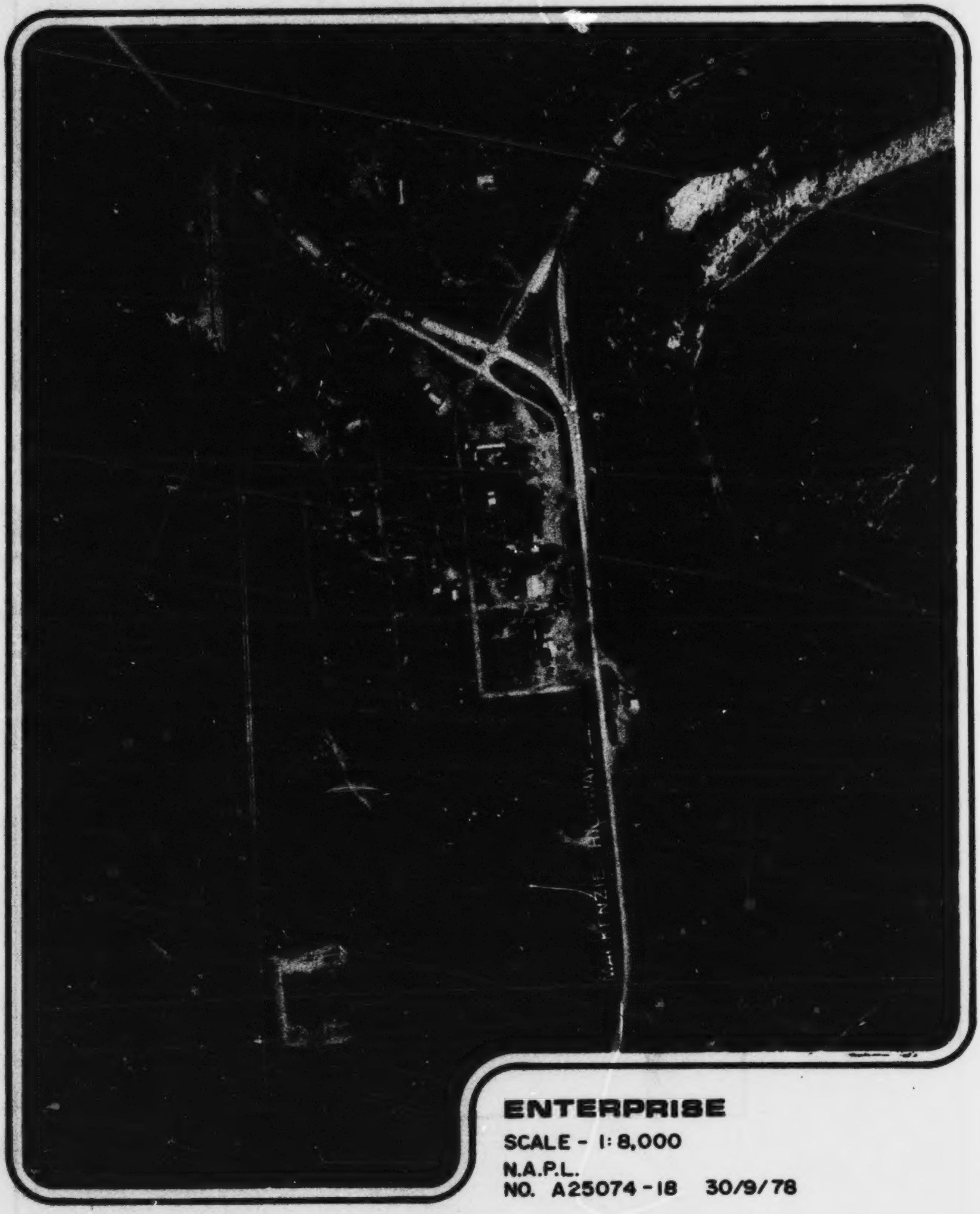
B.6 Power and Other Services
NCPC provides electrical power from Yellowknife. C.B.C. and CJCD radio comes from Yellowknife, as well as T.V. and Telephone service.

INFORMATION SOURCES

Jonas Sangris, Occasion of Visit to Detah of August 19, 1980.

Enterprise





ENTERPRISE

SCALE - 1: 8,000

N.A.P.L.
NO. A25074-18 30/9/78

A. GENERAL

Enterprise, a community of 40 people, located at the junction of the Mackenzie Highway and the highway to Yellowknife, is 43 km south of the Town of Hay River. The Hay River canyon is immediately east of the settlement.

Two service stations were initially built at this location to take advantage of the highway trade. A subdivision was surveyed in 1963 in anticipation of the development of the site as a cargo transfer point and overnight stop. C.N.R. did in fact construct railway siding and loading facilities to the west of the settlement soon after. However, most of the freight for northern points is still handled at Hay River. The projected development at Enterprise did not occur.

The settlement's commercial facilities consist of gas stations, a restaurant, and a six unit motel along the highway. Behind them, two roads segregate rows of house trailers which comprise the residential section. The 1980 population of 40 persons has not changed in three years.

The terrain is flat at the settlement but generally slopes down towards the Hay River from the north to the east.

The top 1.5 m of soil consists of coarse sandy material. This is underlain by fractured Devonian limestone.

The water table is quite high in this area. Enterprise is in the discontinuous permafrost zone, but no permafrost conditions have been encountered at the site that adversely effect development.

The surficial materials are generally less than 2 m of sand with minor gravel overlaying lacustrine clay or the basal clay till. The till thickness is about 3 m at Enterprise.

The bedrock underlying the lacustrine and basal deposits consist of Upper Devonian interbedded shale and limestone of the Hay River Formation. The formation is in excess of 150 m thick underlain by Middle Devonian limestone and dolomite. The bedrock stratum is well exposed along the banks of the Hay River below Enterprise.

The forest surrounding the settlement has predominantly stunted species of black spruce, jack pine and poplar along with the usual hardy brush, mosses and grasses characteristic of the northern climate.

Enterprise experiences an average of 227 days of frost. The mean annual rainfall is 18.3 cm. The yearly snowfall averages 165 cm. The mean daily temperature in January, the coldest month, is -26°C. July's mean daily temperature is + 16°C. The extreme maximum temperature on record is 33.9°C. Similarly the extreme minimum temperature is

Aerial view

Sewage pumpout disposal

-48°C. The ice breaks up in May and the lake freezes over again in November.

B. MUNICIPAL SERVICES

B.1 Water Supply and Distribution

Most of the residents have private wells. Some people purchase water from a private trucked water contractor from the Town of Hay River.

The wells are reported to be 12-24 m deep at Enterprise. Most of the water appears to be present in the top 15 m of the shale or limestone formation. A chemical analysis indicates that the water generally falls within acceptable drinking water standards except for Hardness and Manganese, ie:

Hardness ($CaCO_3$):	314 - 388 mg/l
Manganese (Mn):	0.22 - 0.30 mg/l

B.2 Sewage Collection and Disposal

Most homes have pumpout systems. A private contractor from Hay River comes out every two weeks to pump out the individual household holding tanks.

Sewage pumpout is disposed at a small makeshift lagoon located approximately 4.5 km from Enterprise along the road to Hay River. Seepage from the lagoon discharges into a swampy area north of the site.

B.3 Solid Waste

Garbage is collected and taken to the solid waste disposal site located just south of the sewage lagoon. The garbage is buried. During the winter it is burned before hand. There is an ample supply of cover material in the general vicinity for this purpose.

B.4 Roads and Drainage

Roads are all gravel surfaced. No ditches or culverts are provided to assist drainage in the community. Surface drainage travels overland to the Hay River.

B.5 Fire Protection

A 136 kg fire extinguisher on wheels is stored in a shed for fire protection.

Garbage dump

B.6 Other Services

Power is diesel generated and supplied by Alberta Power via transmission line from the Town of Hay River Generating Station.

INFORMATION SOURCES

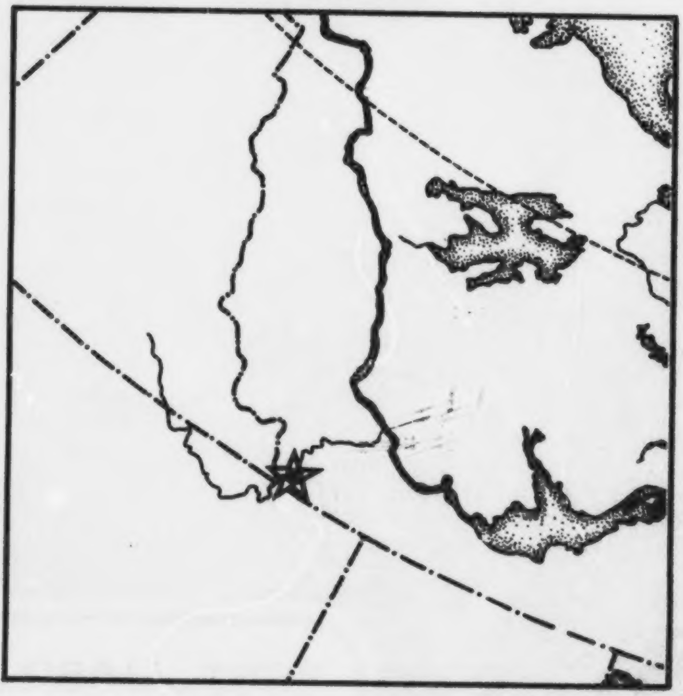
1. Gajda, R.T., Department of Mines and Technical Surveys, *Enterprise, N.W.T., Terrain and Site Analysis,* Ottawa, 1963.

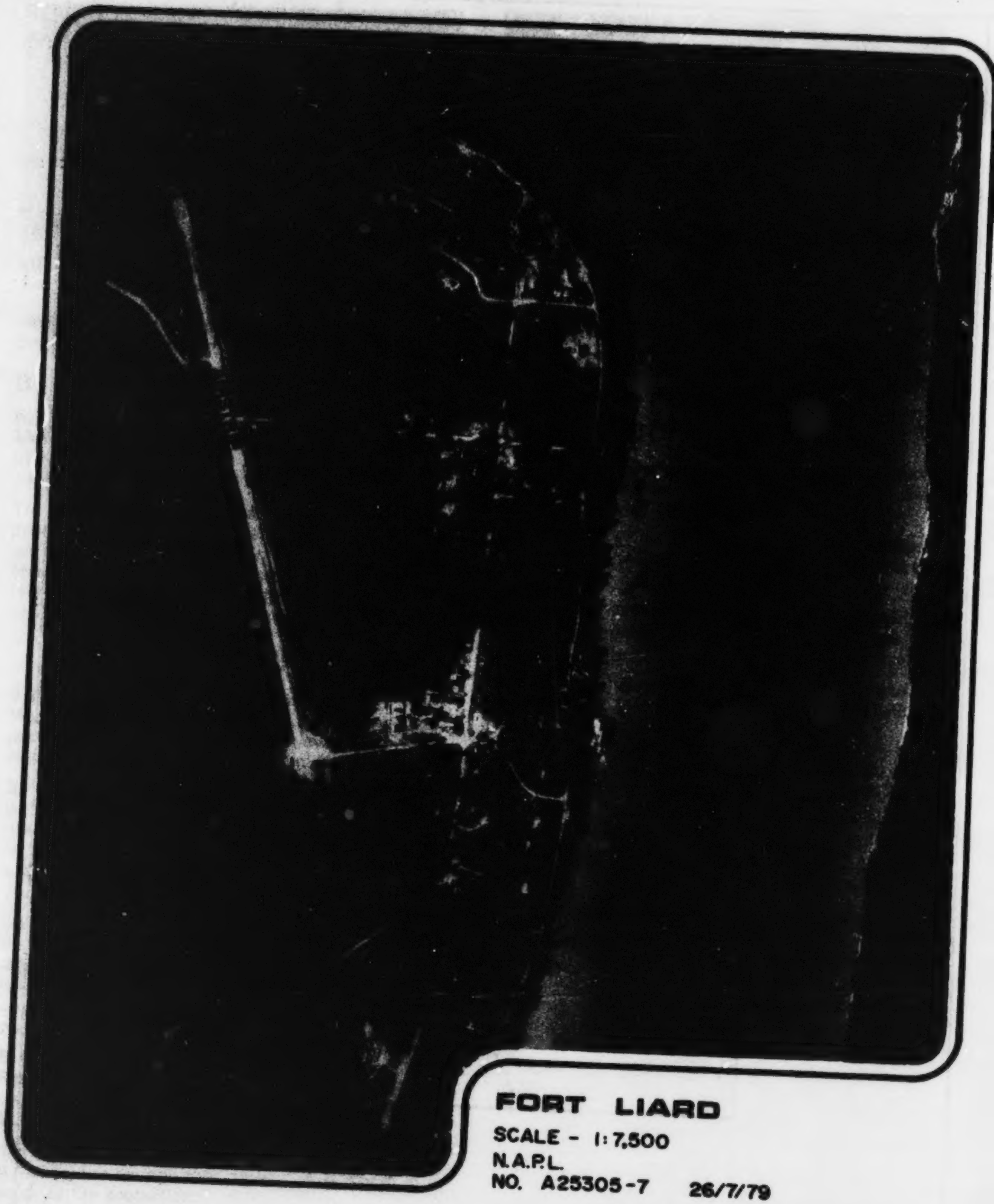
2. Makale, D.L., M.T.P.I.C., Planning Consultant, *Enterprise, N.W.T. Planning Report,* September, 1965.

3. Thurber Consultants Ltd., Hay River - *Enterprise Corridor Groundwater Assessment - Phase I,* February, 1979.

4. N. Bryant, Water Resources, DIAND, *Overview of Enterprise Water Utilities,* (File report) June, 1980.

Fort Liard





FORT LIARD

SCALE - 1:7,500
N.A.P.L.
NO. A25305-7 26/7/79

Aerial view

A. GENERAL

Fort Liard is located at the confluence of the Petitot and Liard Rivers approximately 240 km due north of Fort Nelson, B.C. Yellowknife is 544 km to the northwest. The geographical co-ordinates are 60°15'N latitude and 123°28'W longitude.

The first trading post in the area was set up by the Northwest Company at Fort Liard prior to 1807. This post was taken over by the Hudson's Bay Company in 1821.

Fort Liard is an unorganized community of 342 Slavey and Whites. The population figures for 1979 and 1978 were 344 and 327 persons respectively.

Traditional hunting and trapping are primary sources of income. Seasonal employment by the government and forestry is also available.

The community has a nursing station, two schools, a community centre, Hudson's Bay Company store and churches.

Access is via winter roads from Fort Nelson, B.C. and the Mackenzie Highway. Freight is shipped by barge from Fort Nelson and Fort Simpson. The clay and gravel airstrip is 853 m x 23 m.

The buildings are situated on an alluvial river terrace about 0.8 km wide. Ground elevation on this terrace is approximately 7.5 m to 10.5 m above normal river level. The river bank is stable.

The soil is sand and gravel. Gardening is common in Fort Liard.

Fort Liard is in the discontinuous permafrost zone. No problems with permafrost have been encountered within the cleared developed site.

Spruce and birch grow in the dense forests surrounding the settlement.

Fort Liard enjoys the more moderate climate of the southern N.W.T. In July the mean high is 28°C and the mean low is 12°C. The January mean high and low temperatures are -23°C and -33°C respectively. Rainfall averages 381 mm per year and snowfall amounts to 1321 mm on average. The prevailing winds are southwesterly at 8.7 knots.

B. MUNICIPAL SERVICES

B.1 Water Supply

The domestic water sources in Fort Liard consist of dug and drilled wells. The dug wells, which are about 9 m deep, provide good quality water. Drilled wells, which are 12 m to 20 m deep, produce water which exhibits high iron and hydrogen sulphide characteristics. Residents with the latter wells have installed water softeners to alleviate this problem.

Following is a typical chemical analysis of water from a well used by a government owned residence in the community.

Parameters	Values
pH	6.7
Specific Conductance	867 umho/cm
Calcium (Ca)	41
Magnesium (Mg)	50
Total Hardness (as $CaCO_3$)	308
Sulphate (SO_4)	40.5

(Sampled by DIAND - May, 1979 - Well of NWL & FS residence)

The government homes and buildings all have wells. Although a few private homes have wells, the majority of natives without pressure systems carry water in pails from two community wells. Some residents find it more convenient to draw water directly from the Petitot River.

B.2 Sewage Disposal
Buildings with pressure water systems generally have septic tanks and leaching beds. Privies are used by most of the native population.

B.3 Solid Waste
Garbage is hauled to the dump twice per week using a tractor and wagon. The dump is located approximately 2.5 km from the townsite.

B.4 Roads and Surface Drainage
The roads are gravel surfaced and drainage is good. Moisture is quickly absorbed into the sub-surface sand and gravel.

B.5 Fire Protection
Volunteers utilize a fire truck with a front mounted pump to fight fires. A two bay firehall is provided in the community.

B.6 Other Services
Other services in Fort Liard include telephone, television and radio service. Mail is delivered regularly.

INFORMATION SOURCES

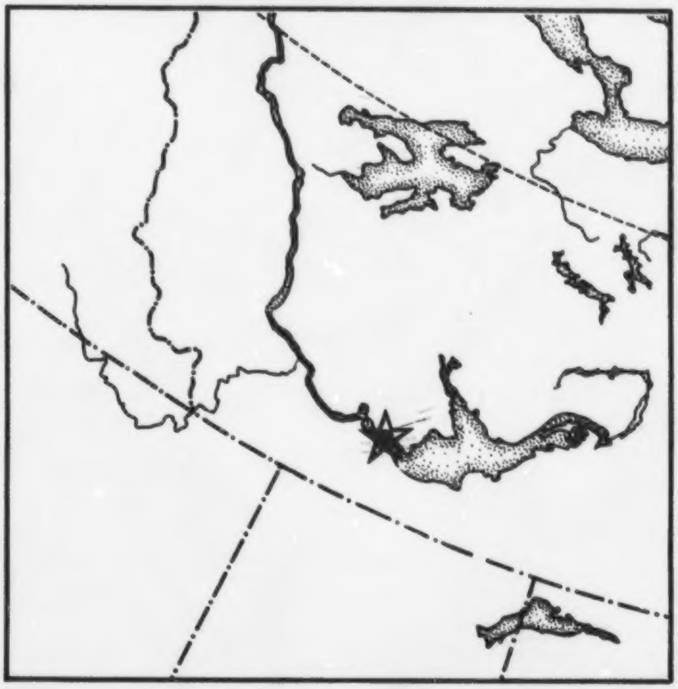
1. Ev Kinsman, Area Maintenance, Hay River, former A.M.O., Fort Simpson, Communication of October, 1980.

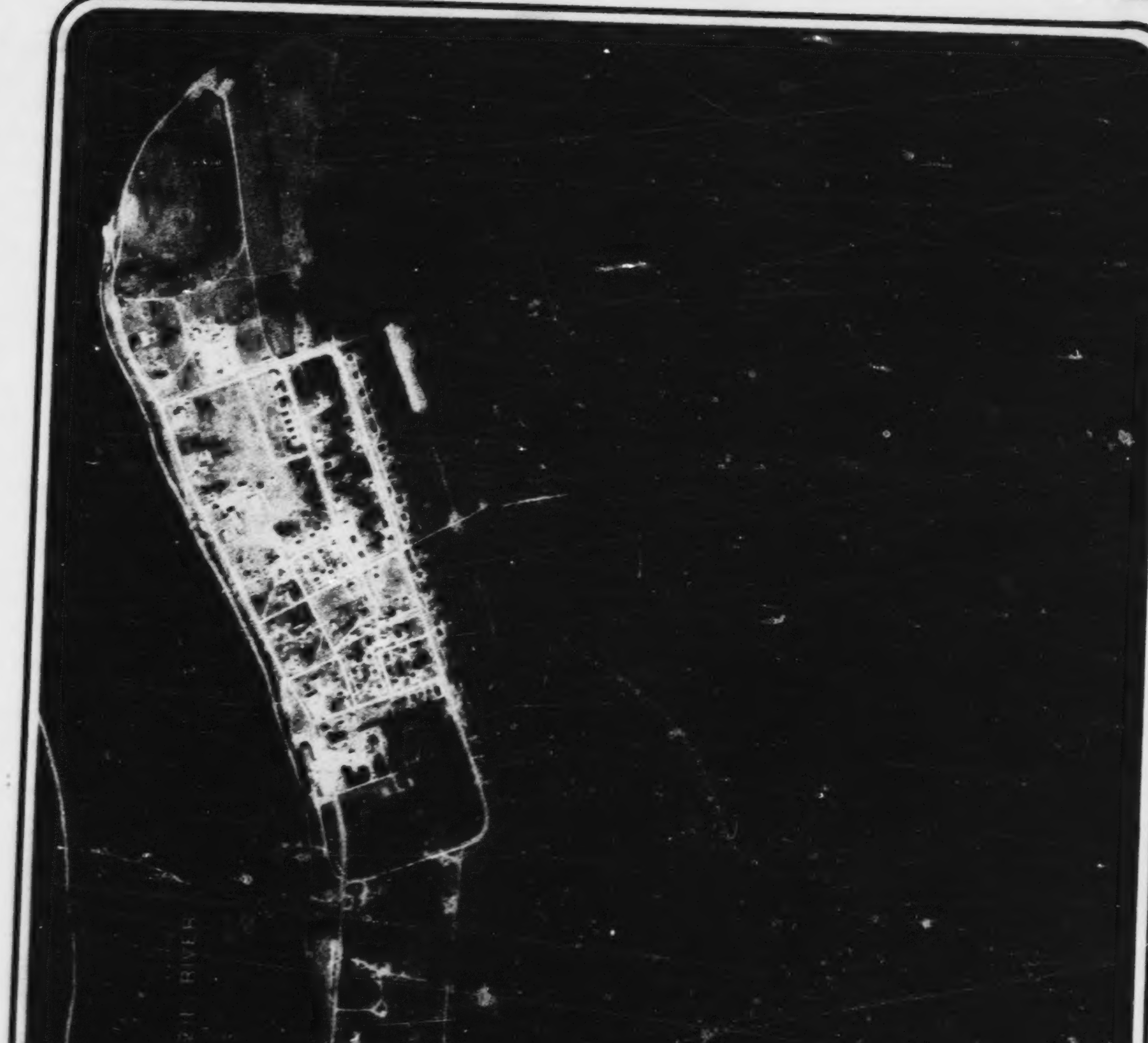
2. Mark McGillivray, Environmental Health Officer, Health and Welfare Canada. *Letter to Head, Water and Sanitation, Department of Local Government, G.N.W.T. re: —Liard Water Supply,* October 10, 1980.

3. Associated Engineering Services Ltd., *Report to Department of Northern Affairs and National Resources on Fort Liard, N.W.T.,* January, 1963.

Gardening in Fort Liard

Fort Providence




MACKENZIE RIVER
SEWAGE LAGOON SYSTEM
WATER INTAKE TREATMENT AND STORAGE AREA

FORT PROVIDENCE

SCALE - 1: 30,000
N.A.P.L.
NO. A25253-160 16/7/79

Community water truck at truck fill point

A. GENERAL

A.1 Location

Fort Providence is located on the northeast bank of the Mackenzie River about 80 km downstream from Great Slave Lake. The geographical co-ordinates of the community are approximately 61°21'N latitude and 117°39'W longitude. It is situated 225 km by air southwest of Yellowknife.

A.2 History

Peter Pond set up a trading post at the site of the future community in 1786. It closed after two years but was re-opened in 1789 by Laurent LeRoux, Alexander Mackenzie's assistant. The post was abandoned again in the 1820's. A Roman Catholic mission, Notre Dame de la Providence, was built in 1861. The Fathers turned the area into one of the largest agricultural centres of the Northwest Territories.

The R.C.M.P. eventually posted two men at the community and a forestry complex was built. Fort Providence offers full services to the traveller.

A.3 Community Information

Fort Providence is classified as a settlement. During the past few years, the population has remained relatively constant as indicated by the following figures:

POPULATION	YEAR
556	1978
571	1979
554	1980

About 76% of the total population is composed of native peoples. A large proportion of residents is dependent on the Federal and Territorial governments for their livelihood. Hunting, fishing, and trapping also provide employment for a number of residents. Community facilities include a handicraft co-operative, a nursing station, a primary school (Kindergarten - Grade 9) and a community centre. A 914 m x 30 m gravel surfaced runway is located about 4 km southeast of the settlement at 160 m A.S.L.

A.4 Geology and Terrain

The land in the vicinity of Fort Providence is characteristic of the Interior Plains physiography, being relatively low lying, heavily wooded and poorly drained with large areas of muskeg. There are a few bedrock exposures, most of them being along the shores of Great Slave Lake and parts of the bed of the Mackenzie River.

The settlement itself is situated on a silty, sandy pebble till plain which stretches back about 3/4 km from the edge of the Mackenzie. Beyond this, the area is swampy and covered with organic material. Fort Providence is located in a zone of discontinuous permafrost. The active layer is approximately 3 m thick.

A.5 Vegetation

The natural vegetation of the region includes small trees such as poplar, spruce, birch and willows. Grasses and small shrubs grow throughout the area.

A.6 Climate

The mean July highs and low temperatures are 23°C and 10°C respectively while the January highs and lows are -22°C and -31°C. Precipitation consists of an average of 146 mm rainfall and 1135 mm of snowfall. The prevailing winds are easterly at about 20 km/hr.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

There are two trucked water suppliers in operation in the community. The settlement contract covers most of the community while the Snowshoe Inn truck supplies the firehall, forestry building, cafe and motel.

B.1.2 Source

The source of water for the community is the Mackenzie River.

The Snowshoe Inn pumps most of its water from a well with a depth of 4.9 m below the normal Mackenzie River water level. It is located near the Mackenzie River shore. According to the proprietor of the Snowshoe Inn, the well water is supplemented by an average of 13 600 L/day from the settlement's treatment plant.

B.1.3 Intake Facilities

The community's intake is located 1.5 km upstream from the settlement. It includes two pumps, one of which is submerged in the wet well. From the wet well, the water is pumped to a treatment and storage building approximately 40 m from the riverbank. Specifications for the intake pump are as follows:

Type:	submersible pump
Capacity:	560 L/m @ 522 kPa (123 Igpm @ 175' TDH)
Motor:	8.2 HP, 3450 RPM, 3 phase, 60 Hz

B.1.4 Treatment

The Town's water is chlorinated and softened. A Wallace and Tiernan hypochlorinator is used for disinfection.

After the chlorine solution is added and the water has passed through the P & S Limited softeners, it goes into an indoor storage tank with estimated dimensions of 3 m x 3 m x 2 m.

The Snowshoe Inn does not treat its water.

B.1.5 Storage

The Snowshoe Inn has a 45 500 L (10 000 Igal) underground cistern that is filled by the water truck from the settlement's water plant. This cistern is used to supplement well water.

B.2 Water Distribution

B.2.1 Piped System

The only piped system in the community is operated by the Snowshoe Inn. It supplies the firehall, a trailer, the Inn and the coffee shop. The plastic pipes are 30 mm in diameter, shallow buried and non-insulated. Water is constantly circulated to prevent freezing.

B.2.2 Trucked System

Most of the water is distributed by the village with a 9100 L water truck. An average of 5 trips per day are made by the truck. The largest consumer is the school which sometimes requires two trips each day.

The Snowshoe Inn also provides some delivery service. Three or four loads per day are delivered to the Inn as well as a tankful to the nursing station and the forestry complex. A Wilson pump is located in the back of the 8200 L tank truck.

B.3 Sewage Collection

The sewage pumpout contract for the whole community is held by the Snowshoe Inn. A GMC truck with a 4550 L tank makes an average of 12 trips per

Garbage dump

day. The sewage is pumped out of the holding tanks by a pump operated directly off the truck engine.

All residences are equipped with pumpout tanks in the community.

B.4 Sewage Disposal

Sewage is deposited into a series of lagoons located beside the dump approximately 3 km east of the settlement.

The lagoon system functions well. It consists of a series of four cells with the final effluent flowing into a swamp which drains into three natural ponds about 1 km distant. The lagoon system is well maintained. The sewage flows through three cells approximately 37 m square to a larger lagoon about 134 m long and 42 m wide. The discharge pipe to the swamp area is about 2 m from the bottom of the lagoon. Discharge only occurs during spring breakup.

B.5 Solid Waste

B.5.1 Collection

Garbage is placed in 205 L (45 Igal) drums by the road and are emptied twice a week by a private contractor using an old International garbage compactor.

B.5.2 Disposal

The garbage dump is located adjacent to the sewage lagoon approximately 3 km from the settlement. Metals are separated from the rest of the garbage. Every two or three weeks the contractor uses a crawler tractor to bulldoze the garbage together and cover it.

Garbage truck

B.6 Roads and Drainage

Roads in the community are all gravel surfaced. There are several gravel sources adjacent to the community. The community drainage system consists of ditches and culverts which discharge to the Mackenzie River.

B.7 Fire Protection

Fire protection in Fort Providence consists of the following:

Sewage pumpout truck

- one (1) 1970 wheeled triple combination pumper capable of pumping 34 L/s @ 1034 kPa
- a firehall to house the truck and equipment
- a 10-man volunteer fire brigade
- annunciator panel in firehall with call boxes in community

B.9 Other Services

Other services include an outdoor swimming pool, pool hall, skating rink, CBC radio, and postal service three times a week. Power is diesel generated and supplied by Alberta Power Ltd.

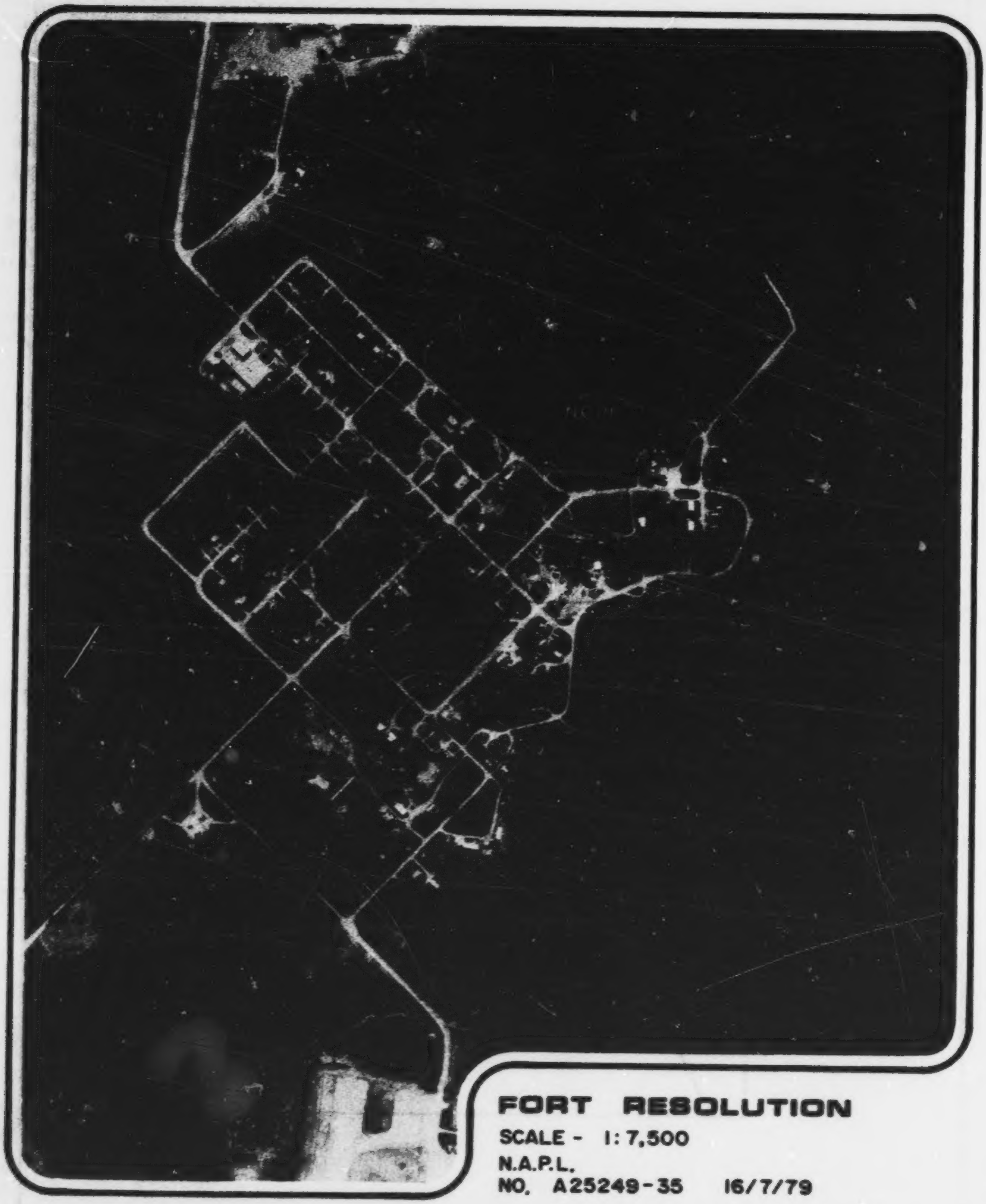
INFORMATION SOURCES

1. Bryant, Neil, Area Head - Fort Smith, Keewatin, and Baffin Districts Water Resources, DIAND, N.W.T., *Overview of Fort Providence Water Utilities,* Report of visit of June 19, 1980.

2. Underwood McLellan & Associates Ltd., *General Development Plan for Fort Providence, N.W.T.,* October, 1970.

Fort Resolution

- one (1) acre



FORT RESOLUTION

SCALE - 1: 7,500

N.A.P.L.
NO. A25249-35 16/7/79

Fort Resolution

A. GENERAL

A.1 Location

Fort Resolution is located just southwest of the Slave River Delta on the south shore of Great Slave Lake. The community is built on a peninsula in Resolution Bay, 158 m - 163 m above sea level. Its coordinates are 61°11'N latitude and 113°41'W longitude and it is 153 km by air from Yellowknife.

A.2 History

Cuthbert Grant and Laurent Leroux established a Northwest Company trading post on the Slave River Delta in 1786. A few years later the Fort was moved to nearby Moose Deer Island. The Fort on Great Slave Lake was rebuilt and then named Fort Resolution. The Moose Deer Island settlement was subsequently abandoned. St. Joseph's Mission House was moved to its present site in 1890. An R.C.M.P. detachment was established in 1913. A three-storey, 80-bed frame hospital building was erected in 1938-39 expressly for tuberculosis cases. The patients were eventually transferred to Edmonton. A resident nurse supervises the new nursing station.

Intake Pumphouse

A.3 Community Information

Fort Resolution has settlement status. Chipewyan and English are spoken by the predominantly native residents. Population figures have remain stable over the past three years:

POPULATION	YEAR
521	1978
523	1979
512	1980

A co-operatively owned sawmill employs 20 to 25 local people. The remainder of the population find employment through handicrafts, trapping or government work.

Facilities in Fort Resolution include a library, an elementary school, an unheated swimming pool and a community centre.

The gravel airstrip is 1265 m x 30.5 m at 164 m A.S.L., but main access to the community is by 70 km gravel road connecting the settlement to Pine Point.

A.4 Geology and Terrain

The coast of Resolution Bay is swampy as the water table is high. The settlement is located on land that is flat and clear of trees.

Below the surface layer of organic matter are 1 m -1.5 m of fine sand and silt. Underneath are alluvium and glacial drift deposits noted to be up to 37 m thick. These deposits are underlain by Devonian limestone. This bedrock is exposed in several locations in the settlement.

Permafrost is found at depths of 0.5 m or greater under tree covered areas. The discontinuous permafrost exists at depths under the community at which it poses no construction problems.

A deposit of rounded stones and gravel suitable for road construction is found 3.5 km from the settlement.

A.5 Vegetation

Spruce, birch, poplar and willow grow thickly in the Fort Resolution area. Trees may reach heights of up to 12 m. The ground cover consists of mosses, grasses and bushes.

A.6 Climate

The mean daily temperature in January, the coldest month, is -26°C. The mean daily temperature in July is 16°C. An average of 158 mm of rain will fall in a year. The mean annual snowfall is 1540 mm. The number of frost free days averages 138.

B. MUNICIPAL SERVICES

B.1 Water Supply

There are records of at least 14 wells that were drilled in Fort Resolution but none of them produced good potable water. The water from these wells was found to be highly mineralized. Water was taken from the lake at the main docks and delivered by tank truck. In 1974 an intake, treatment facilities and storage tanks were completed. The residents are served by trucked water delivery.

B.1.2 Source

Great Slave Lake water is of good chemical quality. The Slave River, however, discharges turbid coloured water that affects the supply during the ice-free months. Turbidity is increased in the shallows by Fort Resolution because wave action and currents lift fine sediments from the lake bottom. The water in the lake several miles offshore is sediment free and reasonably soft, as shown by the following chemical analysis: (All values in mg/L unless otherwise noted)

Parameter	Value
pH	6.8
Specific Conductance	262 umho/cm
Calcium (Ca)	25.6
Hardness (as $CaCO_3$)	101
Alkalinity (as $CaCO_3$)	32
Sodium (Na)	26
Chloride (Cl)	7.2
Sulphate (SO_4)	33
Turbidity	4.5 JTU
Colour	10 Units

(Sampled by Water Resources, DIAND)

B.1.3 Intake Facilities

The intake pipe is composed of eighteen 6.1 m sections joined by 0.91 m flexible sections. It extends 213.4 m into the bay and is anchored by steel rods driven 1.2 m into the bay bottom. The initial 122 m of the intake is heat taped, insulated and shallow buried.

The intake, the end of which is covered with a larger screen, accommodates flow into the wet well under the intake pumphouse all year round.

Water is pumped from the wet well through 114.3 m of 75 mm diameter copper pipe in an insulated non-heat-traced wooden surface utilidor to the treatment plant. An automatic solenoid valve drains the line when the pump is not working, preventing freezing of the pipe. The intake pumphouse contains a small heater, and a fan blows heated air into the wooden utilidor.

B.1.4 Treatment

The water is processed in a Neptune Waterboy Model WB-82 package water treatment plant capable of producing 227 L/m @ 95.5 kPa (50 IGPM @ 32' TDH) of treated water.

Chlorine, alum, soda ash and a polyelectrolyte are added to the water which is subsequently filtered and delivered to two 17 000 IG insulated storage tanks.

The package plant includes a mechanical flocculator and a tube settler. From the latter, water passes through a mixed media bed. This filter type is characterized by long run times and resistance to surges.

When a difference in pressure across the filler bed reaches 20.7 - 24.1 kPa (3 - 3-1/2 psi) or 2.1 to 2.4 m a backwash cycle is initiated automatically. The end suction pump cleans the filters for 10 minutes and a sump pump sends the backwash water to a large settling tank. In the summer, this tank drains slowly to an outdoor fenced retention pit from which the water percolates down to the lake. To prevent pipe freeze-up in the winter, the contents of the backwash tank are released to the pit all at once.

When the temperature of the water in an outside storage tank falls below a certain level an oil-fired boiler comes on line. Two circulation pumps are available to carry heated water back into the tank.

B.1.5 Storage

Two 17 000 IG insulated storage tanks are located adjacent to the treatment building. Only one tank is filled during the winter. In summer both tanks are utilized, as a swimming pool requires the extra water.

B.1.6 Pumping Facilities

A number of pumps are incorporated into this treatment facility. The intake pumphouse on the shore contains the main supply pump:

1. Function: To pump lakewater to the treatment building
   Type: Layne and Bowler Vertical Turbine Model 6TH
   Capacity: 189 L/m @ 119.4 kPa (42 Igpm @ 40' TDH)
   Motor: 3-stage, 2 HP @ 1750 RPM, electric

The treatment building contains the following pumps:

2. Function: Chemical feed pumps
   Type: Precision control pump, Model 9701-11
   Number: 4
   Capacity: 227 L/d @ 862 kPa (50 Igpm @ 125 psi)
3. Function: Filter pump; draws water through filter
   Type: Crane
   Capacity: 181 L/m @ 45 kPa (180 Igpm @ 15' TDH)
   Motor: 5 HP, 230V, 25 amp, 60 Hz, 1750 RPM, Brook electric
4. Function: Backwash pump
   Type: Crane Deming
   Capacity: 1741 L/m @ 134.3 kPa (383 Igpm @ 45' TDH)
   Motor: 5 HP @ 1750 RPM
5. Function: Reclaimable waste pump
   Type: Crane Deming
   Model: I262P, 4511-3S
   Motor: 1.5 HP @ 1150 RPM
6. Function: Recirculation pumps; draws water from storage tanks to boiler and back into tanks
   Type: Taco end suction centrifugal, Model 1700C-7368
   Number: 2
   Capacity: 75.7 L/m @ 59.7 kPa (16.7 Igpm @ 20' TDH)
7. Function: Truck supply pump
   Type: Peerless, end suction centrifugal
   Model: 2" x 1-1/2" close coupled
   Capacity: 302.8 L/m @ 89.5 kPa (66.6 Igpm @ 30' TDH)
   Motor: 1 HP @ 1750 RPM

B.2 Water Distribution

Chlorinated and filtered water is drawn off a storage tank and delivered through a Neptune trident meter to an outside truck fill arm. Water deliveries are made six days per week in an 8183 L (1800 Igal) tank truck. The average domestic water storage tank has a 1137 L (250 Igal) capacity. Res Trucking has the current water delivery contract.

It was estimated (Reference 4) that about 50 housing units have internal plumbing and 70 do not. Those with internal plumbing use approximately 4540 L a week while those without consume about 454 L a week. The average water consumption is just under 68 Lpcd (15 igpcd).

B.3 Sewage Collection and Disposal

Approximately 50 homes have a septic system. Many of these are cribbed pits with no drainage tile and require pumpout at least once per year. Other residents use outside privies or indoor 500 Igal holding tanks. A few chemical toilet systems exist. The waste from these is dumped in small pits and backfilled with soil.

Lirette's Trucking has the current contract for sewage pumpout. This firm services approximately 30 houses and disposes of the waste in a small pit across from the garbage dump 2 km from the community. The pit area is very porous, hence percolation results in no build-up of liquid.

B.4 Solid Waste Disposal

The main garbage disposal area, 2 km from the settlement, consists of pits in a cleared sand deposit.

Garbage disposal area

Garbage is dumped into the depressions and occasionally covered with sand. In the winter, garbage is burned.

Cars and other metal waste are left in a cleared area 0.3 km farther down the road from this disposal site.

Garbage is collected once per week. Res Trucking has the current contract.

B.5 Roads and Surface Drainage

The roads throughout the community are gravel surfaced and in good condition. Ditches line the major roads and corrugated metal culverts have been installed. Drainage is not a problem primarily due to the low level of precipitation and porous ground.

B.6 Fire Protection

The 1000 Igal fire truck is summoned by a siren connected to 16 call boxes located throughout the community. There are 8 volunteer firemen.

INFORMATION SOURCES

1. Makale, Holloway & Associates Ltd., Edmonton, *Fort Resolution, N.W.T. Planning Report and Development Plan,* 1966.

2. Department of National Health and Welfare, Public Health Engineering Division, *Report on Sanitation, Fort Resolution, N.W.T.,* July 6, 1971.

3. G.N.W.T. Department of Public Works, *Operations and Maintenance Manual, Fort Resolution, N.W.T. Water Treatment Plant,* 1974.

4. Bryant, Neil, Area Head Water Resources, DIAND, Yellowknife, N.W.T., *Overview of Fort Resolution, N.W.T. Water Utilities,* June 24, 1980.

Fort Simpson

FORT SIMPSON

SCALE - 1: 8,000
N.A.P.L.
NO. A25305-58 26/7/79

Aerial view

A. GENERAL

A.1 Location

Fort Simpson is located on an island at the confluence of the Mackenzie and Liard rivers. It is geographically situated at 61°51'N latitude and 121°22'W longitude. It is 375 air km southwest of Yellowknife.

A.2 History

Fort Simpson is the oldest continuous trading post on the Mackenzie River. It was built in 1804 by the Northwest Company. An Anglican Mission was established in 1858 with a Catholic Mission following in 1894. The community was originally known as 'Fort of the Forks' and re-named after Sir George Simpson in 1921. The R.C.M.P. established a detachment in 1912 and St. Margaret's Hospital was built in 1916.

A.3 Community Information

Fort Simpson achieved Village status on January 1, 1973. The population has decreased somewhat over the past few years as shown by these figures:

POPULATION	YEAR
1080	1978
1001	1979
992	1980

Community services include an R.C.M.P. detachment, a community centre, a hospital, a Hudson's Bay store, a hotel, and a small general store.

An 1830 m x 45 m asphalt runway and a 1524 m x 45 m gravel runway are located southeast of the settlement at an elevation of 169 m A.S.L.

A.4 Geology and Terrain

The Village of Fort Simpson is on an island approximately 4 km long and 1 km wide. The northeast edge of the island, where most of the Village is located, is about 12 m above the water level of the Mackenzie River and there is a gentle slope down to the flood channel. The whole island is situated in the Mackenzie lowlands, bounded by the Precambrian Shield on the east and the Mackenzie Mountains of the Cordillera on the west. The island is continuously being eroded on its northeast flank and silt is deposited on the remaining shores.

The soils consist of a series of stratified silt, fine sands and some organic materials.

Fort Simpson is located in a discontinuous permafrost region. The sub-surface ice is well bonded and non-visible.

A.5 Vegetation

Grasses, flowers and shrubs abound in and around Fort Simpson. The predominant trees are aspen, birch and white spruce.

A.6 Climate

The July mean high and low temperatures are 20°C and 8.3°C respectively. The January mean high and low temperatures are -21°C and -30°C respectively. Precipitation consists of 163 mm of rainfall and 1372 mm of snowfall. Prevailing winds are generally north-northwest at about 4 knots.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Source

Immediately upstream of Fort Simpson, the Liard River joins the Mackenzie River water. The highly turbid Liard River water flows adjacent to the Village and an interface is created with the cleaner Mackenzie River water some distance from shore. Due to problems created with treatment of highly sediment laden water close to shore, as well as ice damage problems, a new intake system was constructed in 1978 to obtain the cleaner Mackenzie River water approximately 1 km from shore.

The water is of good quality and relatively low in turbidity. A partial analysis is as follows: (NOTE: All values in mg/L unless otherwise indicated)

Parameter	Value
Hardness (as $CaCO_3$)	77 - 121
Total dissolved solids	145 - 170
Iron (Fe)	0.05 - 0.17
Colour	5.0 Units
Turbidity	4 - 22 JTU

B.1.3 Intake Facilities

An earlier 200 mm intake pipe extended into the Mackenzie river 45 m. However, it was plagued by ice flows, which damaged the intake structure.

A new intake was installed in 1978 which extends 1 km across the river, far enough to cross the interface between clean and turbid water.

Three intake structures are located 45 m apart on the conduit to minimize the chances of the intake being rendered useless by ice damage. Two of the intake structures are direct pipe end intakes. The third is an infiltration gallery type. This latter one is presently being used.

The conduit is a 305 mm steel pipe encased in a yellow jacket and buried in the river bottom under cobbles and boulders to provide protection from ice damage.

The conduit terminates at a 4.9 m diameter 18.9 m deep concrete well. A low lift pumphouse is built on top of the intake well. This is located along the shore of the Mackenzie as shown in the aerial photo.

B.1.4 Treatment

Raw water is treated at the treatment plant located 610 m upstream of the intake wet well. A shallow buried 200 mm polyethylene pipeline with 75 mm of polyurethane insulation connects the two.

Low level aerial view

In 1981, the treatment plant building will be stripped of all the old equipment (ie., contact, reactor, clarifier) and re-fitted with three pressure sand filters, new boilers and the attendant piping. The chlorination and fluoridation facilities will be the only treatment carried forward from the old plant. The water will be heated by waste heat provided by NCPC.

B.1.5 Storage

A 511 m³ (112 500 Igal) clear well concrete storage container is located under the water treatment plant. It is 8.5 m x 15.2 m x 3.7 m deep and serves as the substructure for the treatment plant.

B.1.6 Pumping Facilities

There are two intake pumps located at the intake wet well.

Type:	line shaft vertical turbine
Capacity:	15.9 L/s @ 255 kPa TDH (210 g/m @ 85′ TDH)
Motor:	7-1/2 HP

Three electric pumps are located in the treatment plant. Two are used as service pumps and one is used as a filter backwash pump. They have a capacity of 5.7 L/s @ 358 kPa TDH (75 Ig/m @ 120′ TDH).

Two gas driven fire pumps are capable of pumping 31.6 L/s @ 627 kPa TDH (417 Ig/m @ 210′ TDH).

B.2 Water Distribution

B.2.1 Piped System

The water supply system is operated by the Village. Most of the water is distributed by an underground distribution system using 150 mm and 200 mm A.C. water mains forming loops and subloops. The depth of bury is about 3 m. Some of the newer installations are 150 mm and 200 mm polyethylene pipe with urethane insulation.

Water is constantly circulated through the system to prevent freezing. This is achieved by 3 vertical in-line, single stage centrifugal pumps with a capacity of 10 L/s @ 500 kPa TDH.

Service connections consist of two copper lines from the main to each building. Each has a small pump to maintain circulation.

B.2.2 Trucked System

A small portion of the community is served by trucked water. About 16 households consume approximately 12 000 L/week. The water is picked up at the treatment plant. A private contractor delivers water twice a week with a 2273 L truck. Five water points are located on the piped system to allow people not able to afford trucked delivery, or those who do not have a connection to the underground system to obtain water manually.

B.3 Sewage Collection

The piped system consists of 200 mm asbestos cement gravity mains with ringtite joints buried at depths of 1.5 m to 3.5 m.

Manholes are constructed of concrete blocks or precast sections. All manholes have frost protection covers. A sewage lift station and a short forcemain serve part of the developed area.

B.4 Sewage Disposal

A gravity outfall discharges raw sewage into the Mackenzie River via a 200 mm diameter steel pipe downstream of the serviced area. The outfall is buried and extends about 60 m into the Mackenzie River.

Some buildings within the community use a septic tank and leach pit system for sewage disposal.

B.5 Solid Waste

B.5.1 Collection

Garbage collection is carried out by the Village. The collection truck is a mini compactor that compresses the garbage to a certain extent. Garbage from commercial establishments is collected on Monday, Wednesday and Friday.

Residential garbage is collected on Tuesday and Thursday. Most people use steel garbage cans or 205 L (45 Igal) drums. Some residents occasionally burn their garbage.

B.5.2 Disposal

Garbage is disposed of at a sanitary landfill site at Mile 295 on the Mackenzie Highway. This is about 6.5 m south of the Village. The garbage is regularly burned and buried.

Water treatment plant

B.6 Roads

The major roads in the community are paved. Many of the other roads are gravel surfaced. This is adequate for the needs of the community. Some of the gravel roads are surfaced with oil to help keep the dust down. Wooden sidewalks have been built along the main roads.

B.7 Surface Drainage

Surface drainage is assisted by ditches and culverts terminating in the Mackenzie River. They are adequately maintained. Occasionally an ice jam forms on the river during breakup which causes flooding.

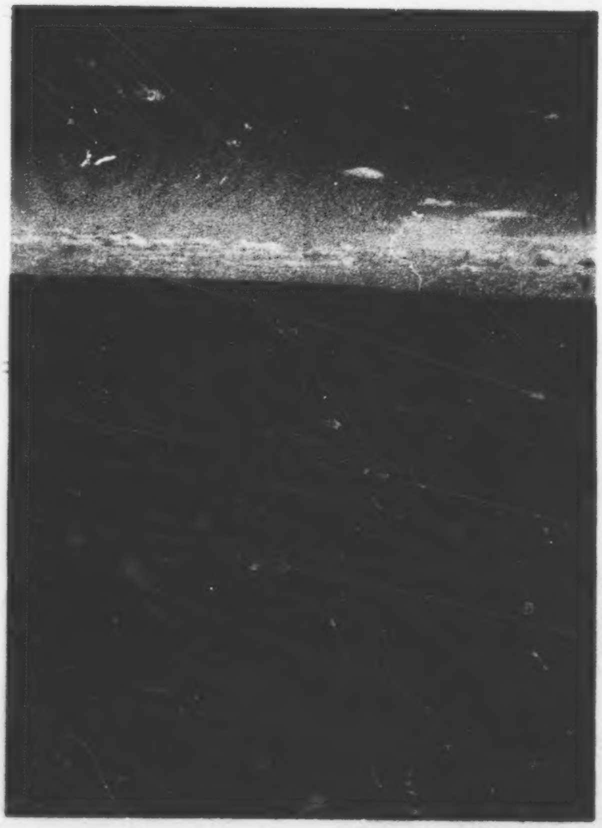
B.8 Fire Protection

Fire protection in Fort Simpson consists of the following:

- a multi-zone alarm system with the call boxes connected to an annunciator panel in a central building;
- one (1) 1961 wheeled triple combination pumper capable of pumping over 34 L/s; and
- a 15 man volunteer fire brigade.

B.9 Other Services

Other services include telephone service by NorthwestTel, C.B.C. radio and T.V. service, and mail delivery 5 days a week. Power is diesel generated and provided by NCPC.



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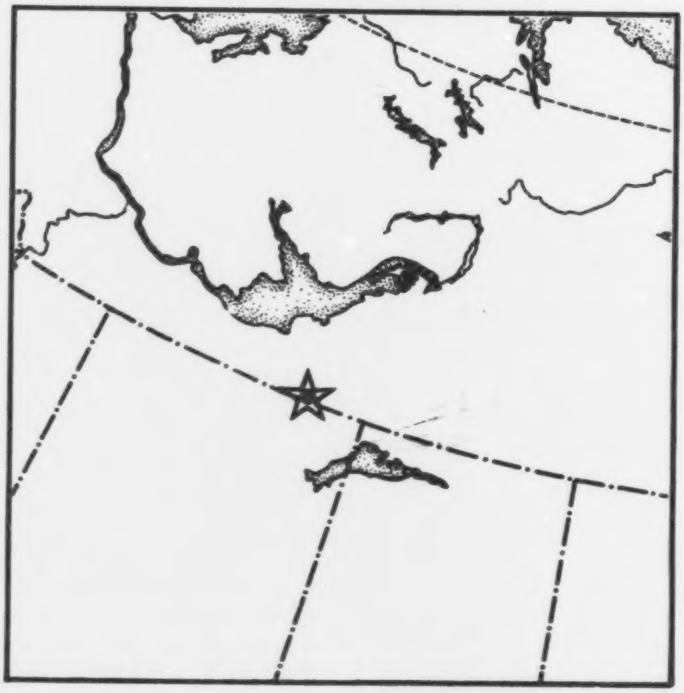
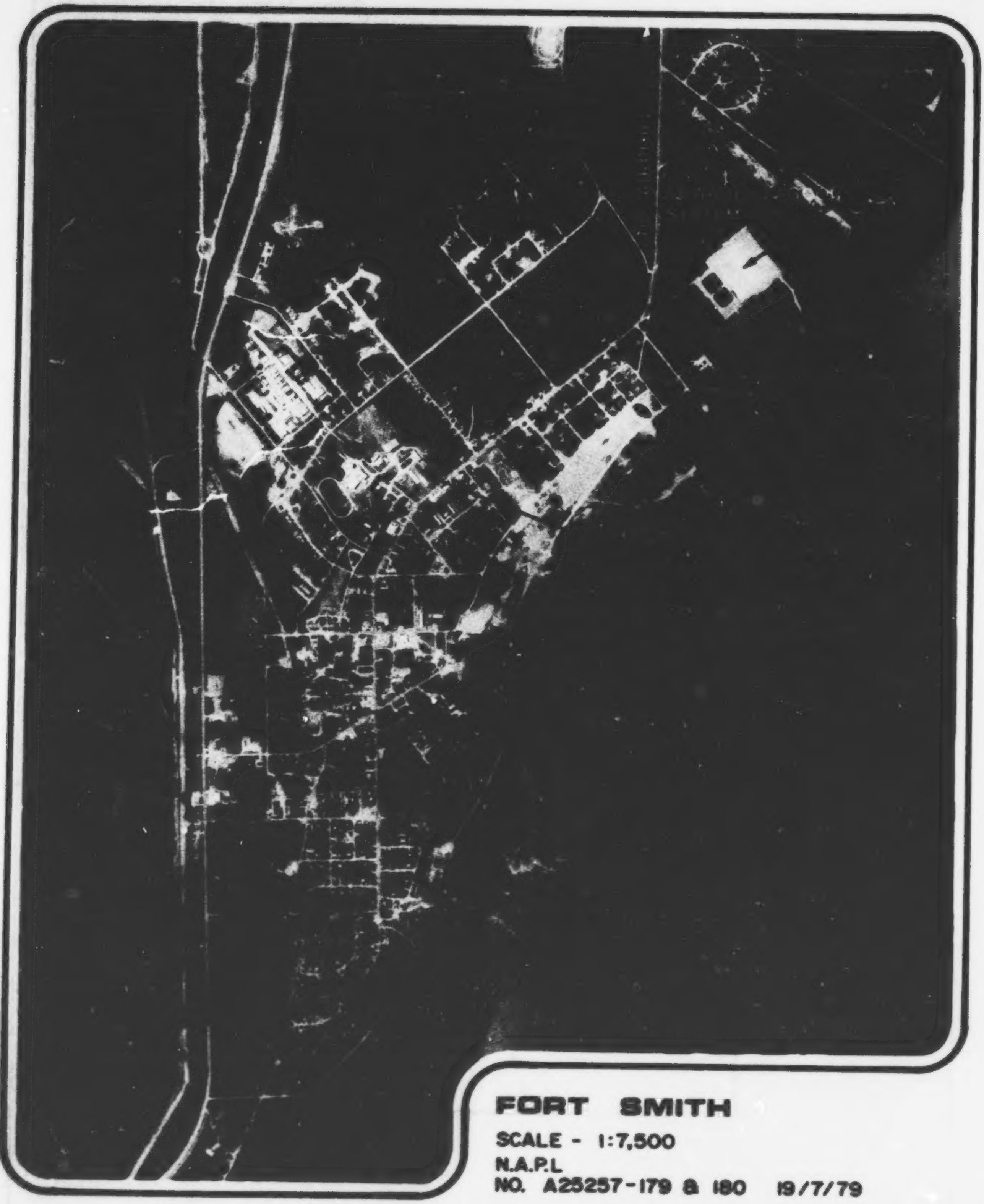
Fort Smith





FORT SMITH

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N.A.P.L
NO. A25257-179 & 180 19/7/79

Aerial view

A. GENERAL

A.1 Location

Fort Smith is a scenic community located at 60°00'N latitude and 111°53'W longitude. The Townsite occupies a 3.5 km strip along the Slave River bank near the Northwest Territory-Alberta border. It is 322 air km southeast of Yellowknife.

A.2 History

A Hudson's Bay trading post was established near the portage route around the 'Rapids of the Drowned' in 1874. The Fort was named for Donald Alexander Smith, later Lord Strathcona, who was a builder of the C.P.R. as well as a Hudson's Bay governor.

A Roman Catholic mission was moved from Salt River to Fort Smith in 1876. It operated a farm and sawmill as a service to the community.

In 1921 the first Federal Government administration building was erected. Wood Buffalo National Park, south and west of Fort Smith, was established a year later.

The airport was built in 1928. Fort Smith soon became an important transportation and administration centre for the Mackenzie district until 1967 when the Government of the Northwest Territories was established in Yellowknife. Today the Town, which achieved that status in October, 1966, is the administrative centre of the Fort Smith Region.

A.3 Community Information

The Town had a population of 2297 in 1980. There has been a decrease in the number of residents reflected in the statistics for 1979 and 1978 - 2234 persons and 2347 persons, respectively.

Metis, Cree, and Chipewyan Indians make up a portion of the population. Their income is derived from government employment and trapping. The area has a good selection of fur bearing animals: beaver, wolf, black bear, mink, marten, rabbit and other wildlife.

There is a substantial number of government employees living in Fort Smith as it is a regular centre for the Government of the N.W.T.

An Adult Vocational Training Centre for the Northwest Territories was set up in Fort Smith. As well, there is an elementary and secondary schools, four churches, an arena, a community centre, a library, a swimming pool, ball parks and a museum; which constitute very good educational and recreational facilities for a northern community.

Two hotels and a taxi service cater to visitors. The Town is connected to the Mackenzie Highway system via Hay River and there are flights 6 days/week to Yellowknife, Hay River and Edmonton. The paved airstrip is 1829 m x 61 m with another 1303 m x 61 m sand strip running at right angles to it. The elevation of the airport is 203 m A.S.L.

A.4 Geology and Terrain

The Town is situated on a plateau 38 m above the Slave River in the discontinuous permafrost zone. The first 9 m - 21 m of soil consists of sand and sandy silt. This layer is horizontally stratified and was glacially deposited. Below is a stratum of silty clay till. This is underlain by granite bedrock with minor local deposits of silty sand and gravel.

Landslides have been precipitated in the geologic past by four related factors; erosion of the riverbanks, river level fluctuations, ground water fluctuations, and soil strength. The most recent landslide, occurred at the Townsite in 1968 and resulted in substantial loss of property and one death.

The Slave River has a mean discharge of 3510 m^3/s (124 000 cfs). The velocities easily erode the sand, silt and clay banks at their bases, creating instability. A rise in the river level results in the development of excess pore water pressures which decreases the sliding resistance of the soil.

There are two aquifers in the Fort Smith area, one confined and one unconfined. The lower confined aquifer is at the bedrock. Pore pressures in this aquifer do not contribute significantly to slope instability. The same conclusion cannot be reached about the upper 20 to 24 m thick aquifer of sand and silt. Increased pore pressures there reduce the sliding resistance of the soil mass. As well, there is a decrease in soil strength with increasing depth. Since erosion of weak soils in the banks will continue without artificial preventative measures, all development in the landslide zone parallel to the river has been forbidden.

A.5 Vegetation

The Fort Smith area is thickly wooded with white and black spruce, poplar, jackpine, some aspen and birch, tamarack, and willow in the low lying areas. There are many varieties of grasses, mosses, lichens, and bushes in the undergrowth.

A.6 Climate

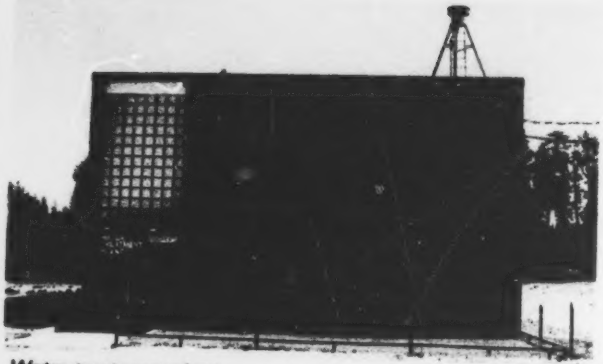
As the southern-most community in the Northwest Territories, Fort Smith enjoys a relatively moderate climate. There are 134 frost free days per year on average. The mean daily temperature in July is 16°C, though temperatures may rise as high as 35°C. The mean daily temperature in January is -27°C. The annual average rainfall is 197 mm, and the annual average snowfall is 1445 mm.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Source

The source of the community's water is the Slave River. Water from the river is of acceptable quality. The only problem is the extremely high turbidity of the river during the spring and summer. The basic water supply system was constructed in 1958 and 1962 with the settlement ponds being added in 1976 to alleviate the problem of high turbidity.



Water treatment plant

B.1.2 Intake Facilities

The Town intake is located just upstream from the 'Rapids of the Drowned'.

A 150 mm insulated transmission main supported on timber blocks connects the intake to the treatment plant 500 m away. Since its construction in 1958, additional pipe has been added to relieve tension caused by displacement of the slope towards the river.

B.1.3 Treatment

Treatment facilities are located in the west part of the Town on the bank above the intake. Water flows to an accelerator where alum and soda ash are added to induce precipitation. During periods of

Elevated storage reservoir

high turbidity the water is first directed to two ponds where settlement of solids occur. Chlorination and fluoridation take place here before passing through two sand bed filters. The water is then stored in a wet well.

B.1.4 Storage

There are two sets of pumps in this system.

Three river pumps discharge water drawn from the Slave River into either the settlement ponds or directly into the accelerator situated in the treatment plant. These pumps were designed for a total combined flow capacity of 2160 L/min @ 543 kPa (475 Igpm @ 182') TDH.

Two service pumps supply water to the elevated water tank. The total flow for both pumps is 2575 L/m @ 448 kPa (566 Igpm @ 150.2') TDH.

Water enters the Town water system from the overhead tower by gravity. If the water level in the tower drops too low, the service pumps in the pumping station sequentially proceed to feed water into the system.

B.2 Water Distribution

B.2.1 Pipe System

The majority of the Town is served by a conventional underground distribution system. Most of the concrete water pipes are 150 or 200 mm in diameter. A computer analysis was carried out on the existing network of water distribution mains to determine the capacity of the network. It demonstrated that the present system is adequate to meet the current flow and pressure requirements.

B.2.2 Trucked System

The remainder of the community is served by a wheeled tank truck. Approximately 44 households require trucked delivery service. The delivery contract is presently held by C & R Construction.

B.3 Sewage Collection

B.3.1 Piped System

The sewage collection system in Fort Smith consists of buried pipe varying from 150 to 200 mm in diameter. Sewage is discharged by gravity to the main lift station or to the two intermediate lift stations where forcemains transmit it to the main lift station.

The main lift station located at McDougal Avenue and Field Street was designed in 1958. The design included two sewage pumps, one to be used as a standby unit. Both pumps are now in use. Specifications for the pumps are as follows:

Type:	Chicago Pump Co. 250 mm impeller pumps
Capacity:	1818 L/min @ 119.4 kPa (400 Igpm @ 40') TDH
Motor:	7-1/2 HP, 1150 RPM

The installation resembles a conventional wet and dry well sewage pump station. A 300 mm cast-iron line discharges sewage into the lift station by gravity. From there it is pumped about 1 km through a 200 mm forcemain to the Town sewage lagoon.

Intake on Slave River

Households not on the piped water and sewage system use either septic tanks or outhouses.

B.4 Sewage Treatment & Disposal

The estimated sewage volume produced by the Town is presently about 600 L/min. The lagoon system consists of three cells located 1 km west of the Town, above the Slave River. Two 50 m x 50 m anaerobic cells allow for primary settling. One large long retention 210 m x 210 m aerobic cell provides treatment before discharge. The retention time in the lagoon system is about 3 months. The lagoons

Sewage lagoon

are lined with an impermeable membrane to prevent seepage. The capacity of the aerobic cell is about 64 million L and it has a surface area of about 4.05 ha (10 acres). An outfall extends from the lagoon to a point in the Slave River approximately 8 m from shore.

A detailed study is currently being undertaken to determine if the effluent quality requires an expanded lagoon with 12 months retention or possibly an extended outfall into the river.

B.5 Solid Waste

Garbage is collected by a truck under contract to C & R Construction. The garbage disposal area is located about 5 km west of the Town on the road to Bell Rock. Garbage is regularly burned.

B.6 Roads and Drainage

The gravel and paved roads in Fort Smith are all well maintained. The paved roads have dirt shoulders and a system of ditches handles runoff. There are no plans to install a piped drainage system. Portions of the ditch system require grading and other improvements to prevent ponding in the spring. Wooden or concrete sidewalks were built along major routes for pedestrian safety.

A gravel highway links Fort Smith with Pine Point and Hay River. A winter road connects the Town with Fort Chipewyan.

B.7 Fire Protection

Fort Smith has a relatively new firehall housing two pumpers. A siren warns the volunteers of a fire. There are some hydrants along the piped water system.

B.8 Other Services

Fort Smith has telephone service, CBC radio from Yellowknife and two television stations via satellite. Mail is delivered 5 days per week. NCPC provides diesel generated power for the community.

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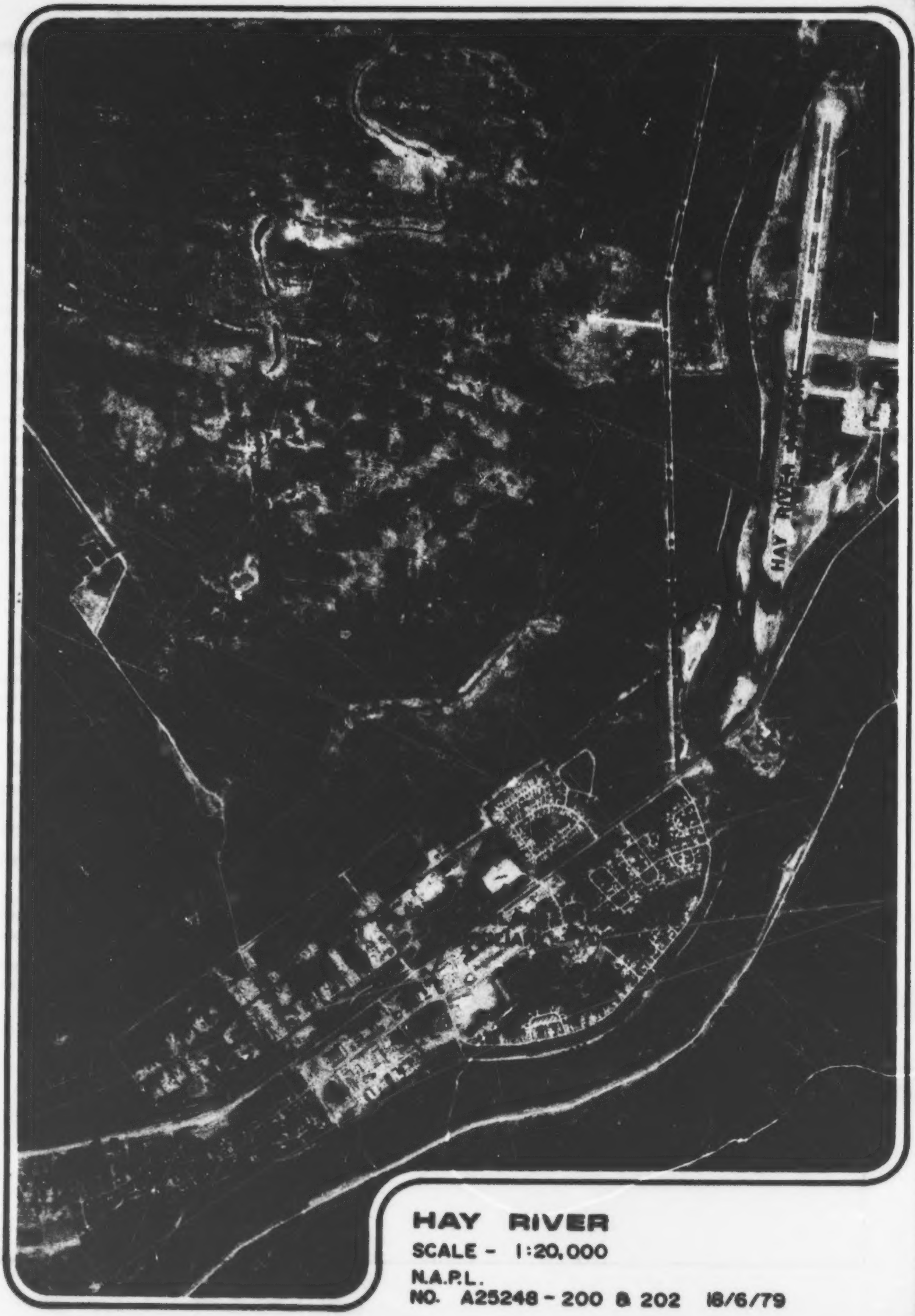
Hay River



HAY RIVER

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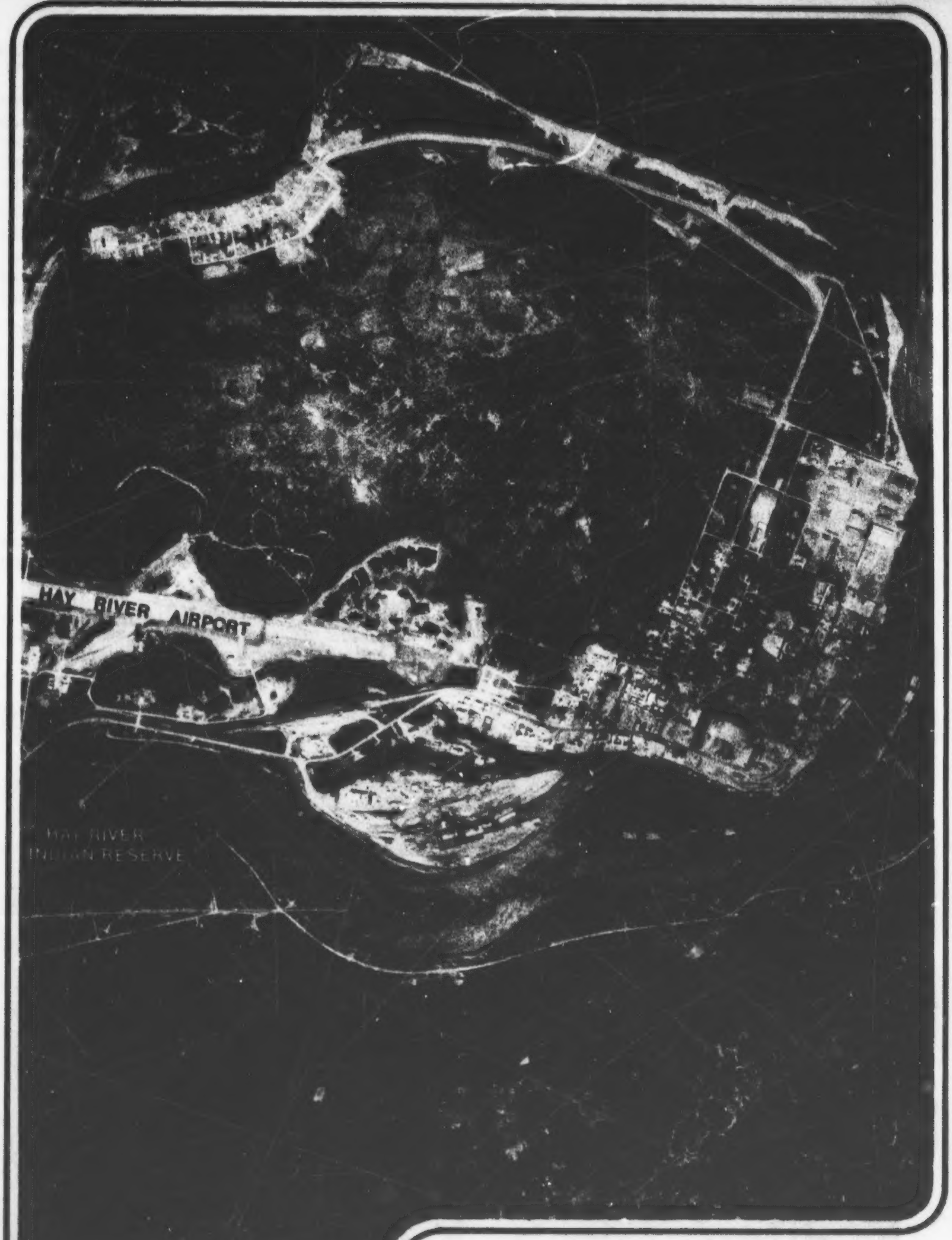
HAY RIVER AIRPORT
HAY RIVER
INDIAN RESERVE

HAY RIVER

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A. GENERAL

A.1 Location

Hay River is a thriving northern community on the south shore of Great Slave Lake at the mouth of the Hay River. Its co-ordinates are 60°51'N latitude and 115°44'W longitude. The Town is 200 km southwest of Yellowknife by air at the intersection of the highway, water and railroad routes. The Alberta border is 134 km away via the Mackenzie Highway.

A.2 History

Although a trading post had been operating intermittently at the mouth of the Hay River before 1893, it was not until that year that continuous occupation of the site began. An Anglican Mission was established to serve the Slavey Indians who congregated there to take advantage of the excellent fishing. A school and nursing station were soon set up by the missionaries. The community, then located on the east bank of the river, continued as an education centre, minor trading post and fishing village until about 1940. With the completion of the Mackenzie Highway in the 1940's, the settlement began to grow. Buildings sprang up on the east side of Vale Island. The west channel fishing village came into being when fish plants were erected away from the rest of the community in 1949. For another five years or so fishing was the main economic activity. Hay River, meanwhile, grew in importance as a trans-shipment centre for goods destined for Yellowknife and other northern points by road and by water.

Two serious floods in 1951 and 1963 caused much damage to the community. They precipitated the development of an alternate residential area on higher ground. Businesses followed and a new central business district was thus created on the mainland.

In the 1960's, general freight ceased to be carried up the Slave River through Fort Smith and the resulting increase in traffic established Hay River as the most economically viable N.W.T. community south of Great Slave Lake.

A.3 Community Information

Hay River is the railhead on the Great Slave Lake Railway, is the major centre of water transportation (Northern Transportation Company) in the Mackenzie River system, is a trucked freight trans-shipment point, and is the key centre for Canadian National Telecommunications land-line and scatter wave systems serving the Northwest Territories. The fishing industry, service industries and government departments round out the sources of employment. The Town has a hospital and extensive recreation facilities for its size.

The 1980 population was 3129 persons. A decline of 271 residents since 1978 has been recorded. Further growth is dependent upon development of the

Old water intake pumphouse/truck fill point

regions Hay River services. The community achieved Town status in 1963.

Along with the aforementioned transportation facilities, Hay River has daily PWA flights to Yellowknife and Edmonton. The paved airstrip is 1829 m x 46 m. A gravel strip at right angles to the paved strip is 1219 m x 46 m.

A.4 Geology and Terrain

The Town of Hay River is at an elevation of 160 m above sea level. Surrounding terrain is very flat. Vale Island, being a mere 3 m or less above lake water level, is subject to flooding during spring breakup.

Underlying bedrock consists of shale, limestone and dolomite. The surface material is a result of glaciation, river development and the shrinking of Great Slave Lake. A hard till occurs at a depth between 5.5 m and 8.5 m. This is covered by a layer of compact silty-sandy gravel which in turn is overlain by water deposited silts and clays. The surface organic material has a maximum thickness of 0.6 m.

The Town is within the discontinuous permafrost zone. Permafrost then is sporadic and may range from 0 to 9 m in thickness depending on organic cover and location.

A.5 Vegetation

The area forms part of the Boreal Forest and is heavily treed. Jackpine, poplar, black spruce, tamarack and willow predominate. Muskeg and swamp are indicative of low lying land.

A.6 Climate

Hay River experiences an average of 227 days of frost. The mean annual rainfall is 18.3 cm. The yearly snowfall averages 165 cm. The mean daily temperature in January, the coldest month, is -26°C. July's mean daily temperature is + 16°C. The extreme maximum temperature on record is 34°C. Similarly the extreme minimum temperature is -48°C. The ice breaks up in May and the lake freezes over again in November.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Hay River has had a piped water supply since the 1960's. A 6.4 km long, 250 mm (10") pipeline extends into the Great Slave Lake. An intake pumphouse sends the water to a booster pumping station, storage tank and mainland pumphouse. Water is subsequently pumped from the tank through the distribution system. A 4,540 m^3 (1 million Igal) underground reservoir and pumphouse forms part of the system.

In 1978, a new water intake and pumphouse were completed. A 355 mm diameter water transmission line from the new facility was connected to the existing distribution piping. Unfortunately, in the spring of 1979 ice damaged the new 8 km intake. Because the pumphouse was not equipped with filters to treat the silt-laden water entering the pipe at the break, the Town fell back on the old intake and pumphouse for a year. Repairs to the intake during the summer of 1980 are expected to bring the new facilities back on line.

Following is a chemical analysis of a sample collected from the bottom of Great Slave Lake near the old intake: (Values in mg/L unless otherwise noted)

Parameter	Value
pH	8.0
Colour	20 Units
Alkalinity ($CaCO_3$)	88.5
Hardness ($CaCO_3$)	94.5
Calcium (Ca)	26.4
Sodium (Na)	8.0
Chloride (Cl)	7.6

(DIAND, 31-3-77)

B.1.2 Intake Facilities

B.1.2.1 Old Intake and Pumphouse

The old intake line consists of 250 mm cement-lined steel pipe extending 6.4 km into Great Slave Lake.

Water flows into the intake pumphouse truck fill point. There the water is chlorinated, heated and pumped through a supply line to the mainland pumphouse.

The three turbine pumps, operating in rotation, pump at least 1.82 million L (400 000 Igal) per day of heated water through the 150 mm steel partially insulated transmission line. The computed capacity of the transmission system is 1887 L/min (Stanley 1975). Pump specifications are given below:

1. Function: To pump water from lake through supply line
   Type: line-shaft turbines
   Number: 2
   Model: Aurora pump - 10 stage
   Capacity: 1890 L/m @ 1164 kPa (415 gpm @ 390') TDH
   Motor: 60 HP, 1770 RPM electric motor
2. Type: line-shaft turbine
   Number: 1
   Model: Johnson vertical pump - 5 stage
   Capacity: 796 L/m @ 686.5 kPa (175 gpm @ 230') TDH
   Motor: 20 HP, 1760 RPM, electric with standby gasoline engine

B.1.2.2 New Intake and Pumphouse

The pumphouse and wet well are located on the northeast section of the mainland about 2 km from the old intake and pumphouse on Vale Island. The concrete wet well holds 341 000 L (75 000 Igal).

The 1977 intake is 610 mm (24") in diameter and made of cement mortarlined steel pipe with an exterior coating of Yellow Jacket No. 1. The first 1.6

km is buried and the remaining 6.4 km of pipe lies on the lake bottom.

The intake structure is 9 m high and anchored by piles. Two screened inlets allow clearer water to be obtained from the upper one in spring while warmer water will flow into the lower inlet in the winter, reducing water heating costs. Screen over the inlets is 12 gauge Copper, 25 mm (1") mesh.

Inside the pumphouse are 4 main open line-shaft vertical turbine pumps capable of pumping 9 million L (2 million Igal) of water per day. One pump is on standby. Water leaves the pumphouse at a pressure of 413.7 kPa. The 4 identical pumps each have these specifications:

Capacity: 1968 L/m @ 537 kPa (433 Igpm @ 180') TDH
Motor: 30 HP, 1750 RPM 60 Hz electric

After heating, water is pumped through the 355 mm steel, cement lined transmission line which is insulated with 50 mm of urethane and covered with a Yellow Jacket.

B.1.3 Treatment

Water is chlorinated at the intake pumphouses. As well as gas chlorination equipment at the 1978 intake pumphouse, fluoridation equipment is available for use.

B.1.4 Storage Facilities

B.1.4.1 Auxiliary Mainland Storage Tanks

An insulated 2 273 000 L (500 000 Igal) 20 year old steel tank is located beside the old mainland pumphouse near the commercial centre of the Town. Water is not heated for this storage facility. It is used primarily to stabilize pressure in the Town's distribution system. Changes in the water level prevent freezing.

B.1.4.2 Covered Reservoir

The recently constructed 4.55 million L (1 million Igal) concrete covered reservoir is in the south residential area. About 23 L/min of heated water are continuously circulated through the reservoir to maintain an adequate distribution temperature.

B.1.5 Pumping Facilities

B.1.5.1 Old Mainland Distribution Pumphouse

The building houses the following service pumps:

1. Function: To pump water through the distribution system
   Type: Weinman
   Number: 2
   Model: AA 213TTDR7613ABW
   Capacity: 909 L/m @ 343.3 kPa (200 Igpm @ 115') TDH
   Motor: 10 HP, 3470 RPM electric motor
2. Function: Fire Pump
   Capacity: 4550 L/m @ 355 kPa (833 Igpm @ 119') TDH

New intake pumphouse

B.1.5.2 Reservoir Pumphouse

This distribution pumphouse has 3 service pumps with the following specifications:

1. Type: Verti-line Aurora Pump
   Capacity: 682 L/m @ 343.3 kPa (150 Igpm @ 115') TDH
   Motor: 7-1/2 HP, 3-stage, 60 Hz, 3500 RPM

The fire pump is as follows:

2. Function: Fire Pump
   Model: Aurora F16EHH
   Capacity: 9090 L/m @ 723 kPa (2000 Igpm @ 242') TDH
   Motor: 1770 RPM

B.2 Water Distribution

B.2.1 Piped System

A 7 km, 150 mm diameter steel transmission line crosses Vale Island from the old intake through the mainland booster pumphouse to the old distribution pumphouse. There are about 20 water service connections to this pipeline on Vale Island.

The mainland distribution network is made up of 150 mm and 200 mm diameter ductile iron pipe buried under 3.4 m of cover.

B.2.2 Truck System

Truck fill points are located at the old water intake and at the former mainland distribution pumphouse.

Approximately 204 households received water by truck in 1980.

B.3 Sewage Collection

B.3.1 Piped System

Between 1.8 and 2.3 million L (400 000 to 500 000 Igal) of sewage are generated per day. The piped sewage collection system is composed of 200 mm and 250 mm diameter vitrified clay pipe.

Three lift stations are provided in the Town, two of which discharge through forcemains directly to a lagoon system for treatment.

Lift Station # 1 pumps through a forcemain to the lagoon and accommodates 80% of the Town's sewage wastes. It is a prefabricated steel station with a wet well and an in-line macerator. The two main pumps each are capable of handling peak sewage flows and have the following specifications:

Pump # 1

Type:	Submersible 12.7 mm (5") pump
Model:	Brown Boveri (Canada) Model 365 UP-DBAVB
Capacity:	4650 L/m @ 280.6 kPa (1022 Igpm @ 94') TDH
Motor:	50 HP, 3-phase, 60Hz, 1773 RPM Electric Induction Motor with right angle drive so it may be run off diesel motor

Pump # 2

Same as above without the right angle drive. Both pumps were installed in 1977.

Lift Station # 2 discharges through a 200 mm forcemain directly to the sewage lagoon. Flow is recorded at Lift Station # 1. This station serves about four residential blocks. The two pumps run no more than two hours per day. They each have a capacity of 2490 L/m @ 250.7 kPa (548 Igpm @ 84') TDH with 3-phase, 1750 RPM motors.

Lift Station # 3 consists of a manhole with a submersible pump. Waste is discharged through a gravity sewer to Lift Station # 1. The pump has a capacity of 796 L/m @ 119.4 kPa (175 Igpm @ 40') TDH.

Sewage lagoon system

Sewage lagoon — drainage channel to swampland

B.3.2 Sewage Pumpout

Vale Island is not serviced by sanitary sewers. Some residences have leach pits, others have privies, and the remainder have sewage pumpout tanks.

B.4 Sewage Disposal

The two lift stations discharge sewage into a 2 celled anaerobic lagoon system which was recently upgraded to include a third smaller cell. The two main cells each hold approximately 1.4 million L (310 000 Igal) and may be operated in series or in parallel.

The effluent flows into the third cell and is discharged into a 6.5 km long drainage ditch that flows through swamp land and eventually discharges to Great Slave Lake.

B.5 Solid Waste

Garbage is collected twice per week using two compactor trucks.

The garbage dump is 8 km from Town off the highway to Pine Point. The solid waste is pushed into deep trenches and covered with earth.

B.6 Roads and Surface Drainage

Roads in newer subdivisions are paved complete with curbs, gutters and storm drains. The older residential districts still have drainage ditches and culverts. All runoff flows into Great Slave Lake or the Hay River through a number of storm drains. Eventually residential streets will all be upgraded to include storm sewers. Open ditches satisfy the drainage requirements in the industrial areas.

Garbage disposal area

B.7 Fire Protection
The Town has four standard fire trucks. The water trucks may be called into service in an emergency. Fire hydrants are connected to the water distribution piping. At least 22 volunteer firemen are on call.

B.8 Other Services
Hay River prints two weekly newspapers, receives CBC Northern Television Service, has CBC radio and an FM station and has telex facilities. There are a number of motels, restaurants and campgrounds to cater to visitors. Power is diesel generated by Alberta Power Ltd. The plant has a capacty of 6000 KW.

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Truck fill plant

Hay River Indian Reserve

A. GENERAL

The Indian Reserve is on the east bank of the east channel of the Hay River at its intersection with Great Slave Lake. The co-ordinates are 60°51'North, 115°44'West. The Town of Hay River is directly across the narrow channel but the only connecting route for vehicles is 22 km long.

The Hudson's Bay Company built a trading post on the east bank in 1868. A Roman Catholic Mission operated from 1869 until 1878. Slavey Indians gathered at the site to trade. It was not until 1939 that the population began to expand. The newcomers, however, settled on the adjacent Vale Island and Hay River's subsequent development left the Indian Village untouched.

The Hay River Indian Reserve, the only one in the Northwest Territories, was created in 1974.

The Indian population on the reserve is split into two villages. People are gradually moving out of the original village to find improved accommodation either in the new village further along the riverbank or in Hay River. The old village is prone to spring flooding.

The new village has 25 to 30 log and frame houses, a small one-room school, and a community centre. There is no commercial development. The permanent residents number less than 200.

The land is made up of 15 to 27 m of alluvially deposited sand, silt and clay over shale bedrock.

Discontinuous permafrost exists but frost action is not a problem on the higher, well drained land where the new village is situated.

The forests in the Indian Reserve are made up of spruce, poplar, pine, alder and willow, with mosses, grasses and brush in the low lying areas.

See description of Hay River's climate.

B. MUNICIPAL SERVICES

B.1 Water Supply and Distribution

Reference should be made to aerial photos for the Town of Hay River. The Indian Reserve receives its water from the Hay River supply system.

A transmission main from Vale Island to a truck fill centre on the reserve was built in 1979. It consists of an insulated water supply line containing a small recirculation line. Specifications are as follows:

Supply Line

Type: Series 100 polyethylene pipe
Diameter: 150 mm
Insulation: 50 mm urethane insulation and yellow jacket coating

Circulation Line

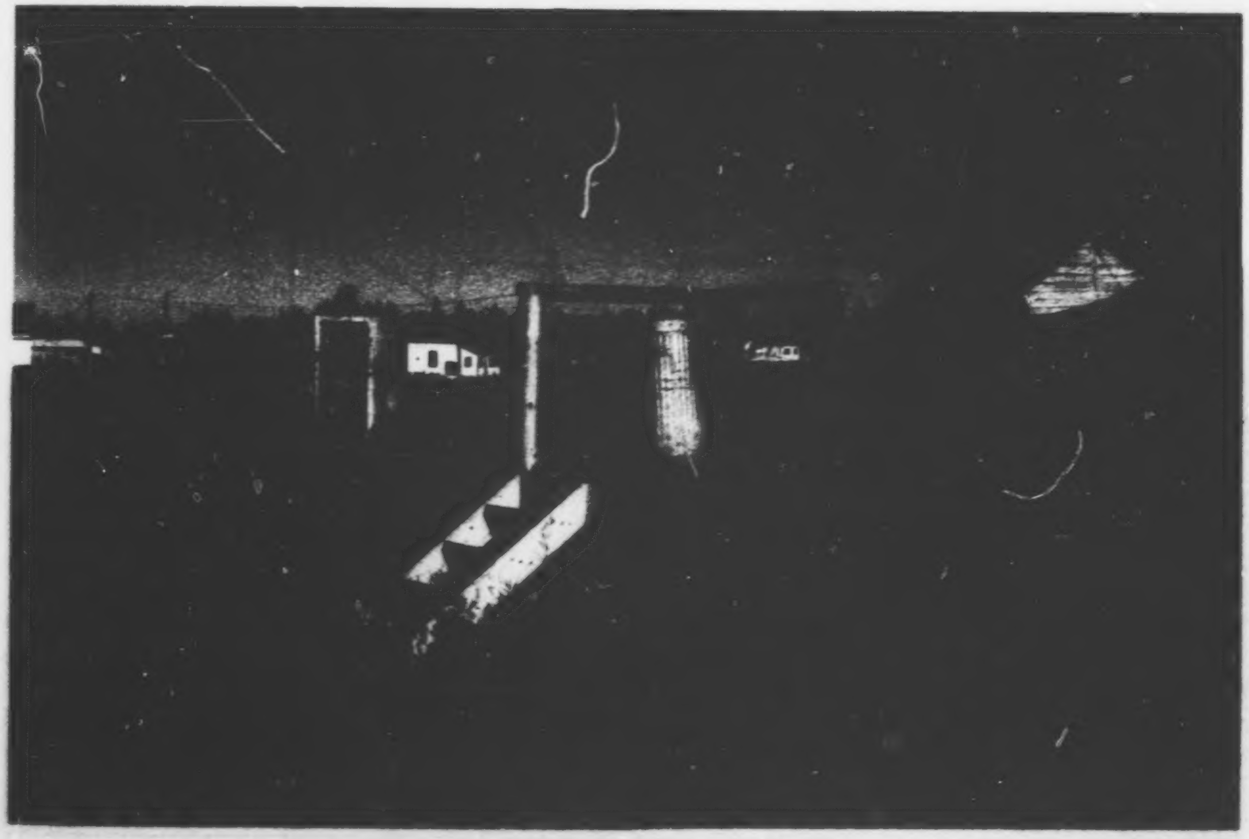
Type: Series 160 polyethylene pipe
Diameter: 38 mm

The water is heated at the truck fill point and returned through the circulation line to prevent the supply line from freezing. Specifications for the circulation pumps are as follows:

Type: Taco 1600 Series Cartridge pump
Capacity: .63 L/s @ 95 kPa TDH (8.3 Igpm @ 32 ft. TDH)
Motor: 1/3 HP, 115 V, 1 phase, 60 Hz, 1,750 rpm

Since its completion, this truck fill centre has received limited use. The water carrier comes from Hay River and usually brings a truck load of water with him. The water through the pipeline is only used if the carrier distributes more than one tankful. According to a contact at Hay River Public Works, it takes 5 weeks for 45,500 L (10,000 Igal) to go through the line.

Deliveries are made by the private contractor once a week. Most of the residents store their potable water in 455 litre plastic containers which sit by the



Garbage stand

road during the summer and are brought inside during the winter.

B.2 Sewage Collection and Disposal

Most residents use pit privies to dispose of their sewage. There are a few pumpout tanks. The sewage is collected by a contractor from Hay River and released into the Hay River sewage lagoon.

B.3 Solid Waste

Garbage is placed in garbage cans or 205 L (45 Igallon) barrels situated on a raised wooden platform outside each residence. The platforms were built by the band council to prevent tipping of the barrels by animals and to make it easier to empty the barrels.

The garbage is collected once a week by the band council. It is carried to the Hay River landfill site and deposited there along with Hay River's garbage.

B.4 Roads and Drainage

Roads in the new village are gravel surfaced and are in a good state of repair. The roads in the old village are merely rough tracks.

Ditches along the roadways and the occasional culvert comprise the drainage system. Since the community is located along the Hay River, all water drains into the river.

B.5 Fire Protection

A fire station consisting of a hose and hydrant is located in the new truck fill centre.

B.6 Other Services

Most other services, such as recreation facilities and entertainment, are available in Hay River. CBC radio and television is available in the community.

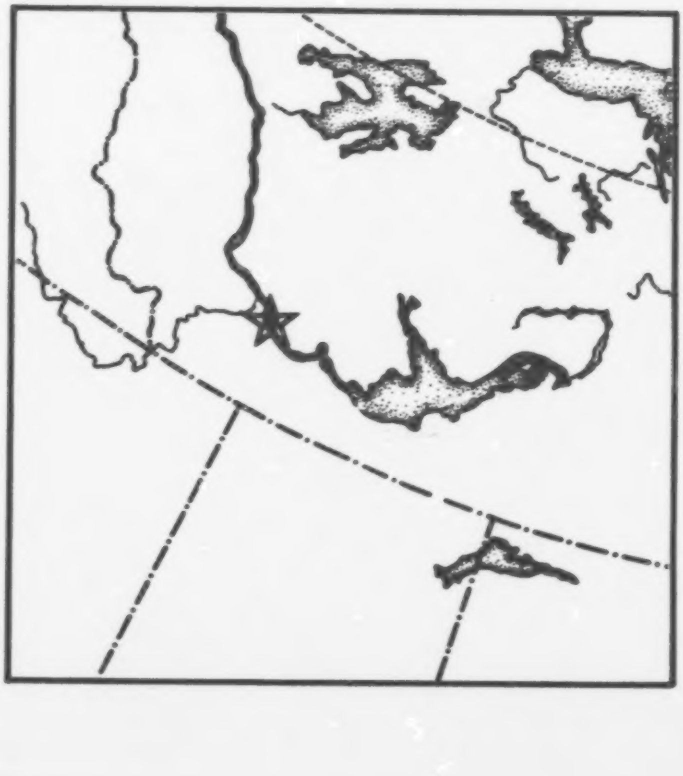
INFORMATION SOURCES

1. Department of Indian & Northern Affairs, Engineering & Architecture Branch, Federal Government, *Hay River Indian Reserve, Number 1, Northwest Territories, Planning Assessment,* Ottawa, December, 1976.

2. Stanley, Grimble, Roblin Ltd., Consulting Engineers, *Report on Planning and Engineering for Hay River, N.W.T.,* Edmonton, 1963.

3. Department of Public Works, Government of the N.W.T., *Specifications for a Water Supply Line for Indian Village, Hay River, N.W.T.,* April, 1979.

Jean Marie River



JEAN MARIE RIVER

SCALE - 1: 7,500
N.A.P.L.
NO. A25371-36 15/5/79

A. GENERAL

This unorganized settlement is situated at the confluence of the Mackenzie River and Jean Marie River. It is 302 km by air southwest of Yellowknife. The geographical co-ordinates are 61°32'N latitude and 120°38'W longitude.

Jean Marie River is a Slavey community of approximately 49 persons (1980). The population was stable for the three previous years. The economy is based on hunting, fishing, trapping and wage employment in the Jean Marie Co-Operative. The sawmill, owned by the Co-op, commenced operations in 1965. It produces dressed lumber from the abundant supply of trees in the area. Fine handicrafts are made in the settlement.

Most homes in the community are of log construction.

Access is via a 35 km winter road to the Mackenzie Highway or by barge from Fort Simpson or Hay River. There is a 427 m earth airstrip beside the settlement.

The river bank, upon which the community is sited, rises 6 m above the river. The underlying strata is made up of till over bedrock. Surface material is sandy clay.

Jean Marie River has a mean July maximum temperature of 25.6°C and a mean minimum of 12.2°C. The January mean maximum and minimum temperatures are respectively -23°C and -33°C. Snowfall averages 1550 mm per year and rainfall averages 380 mm during the summer months. Prevailing winds are northwesterly.

B. MUNICIPAL SERVICES

B.1 Water Supply

Water is obtained from two dug wells as well as directly from the Jean Marie River by residents. One well serves the school and the other is at a local residence.

B.2 Solid Waste and Sewage Disposal

The school and teacherage, equipped with plumb-

Log houses in settlement

ing, utilize a septic tank. The rest of the community uses privies or bagged waste.

Combustible waste is burned by homeowners in 205 L (45 Igal) drums. There is no organized collection of garbage or bagged waste.

B.3 Roads and Surface Drainage

There is no internal road system in Jean Marie River. Paths connect the buildings. Drainage problems are not severe due to glacial drift and alluvial deposits overlying the bedrock.

B.4 Fire Protection

There is no organized fire protection system for the community. Fire extinguishers are supplied to homes, however.

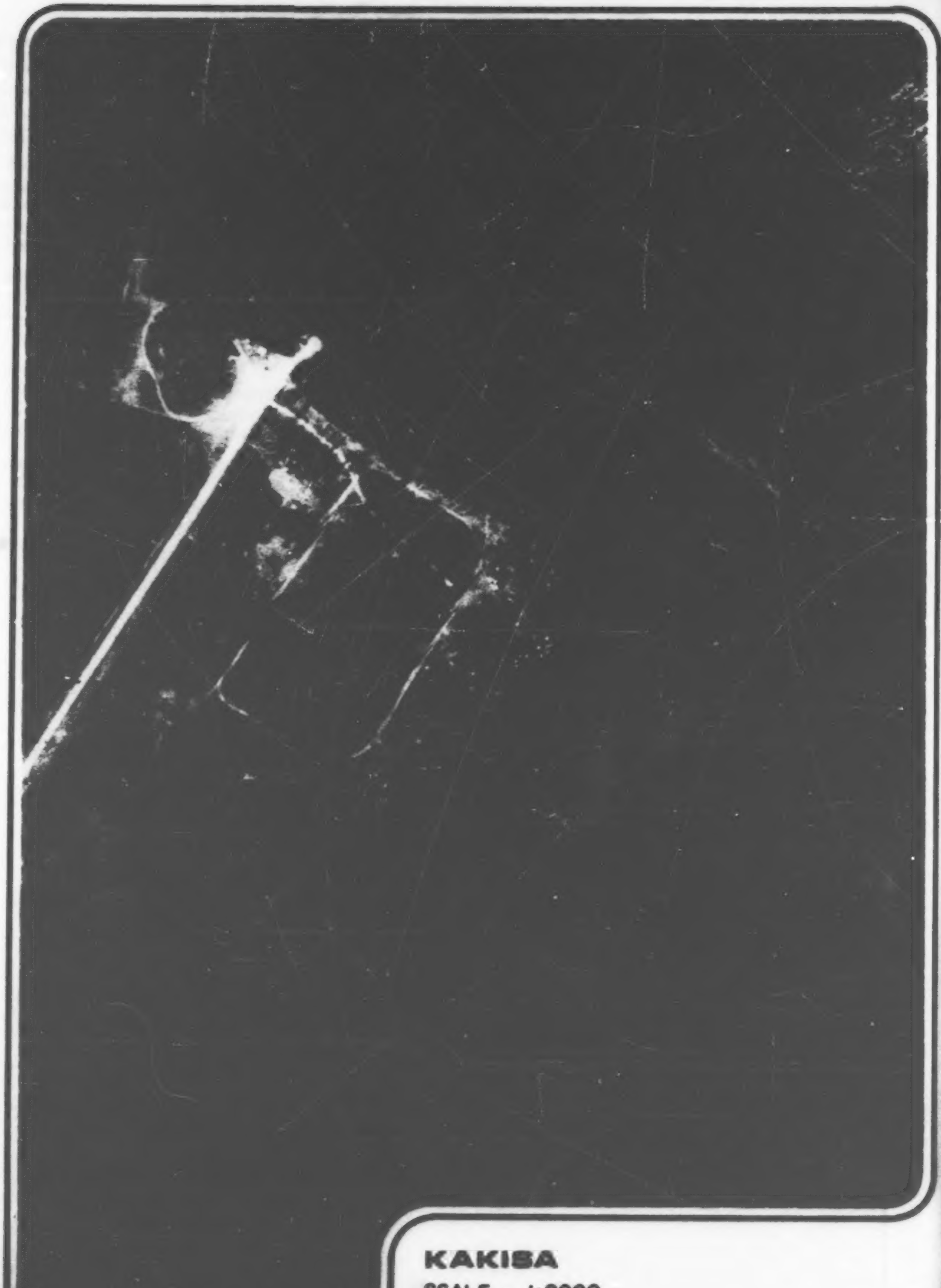
B.5 Other Services

The settlement has CNT mobile radio telephone service, CBC radio from Fort Simpson and mail service twice monthly. There is an elementary school.

INFORMATION SOURCES

Ev Kinsman, Area Maintenance, Hay River, Former AMO, Fort Simpson, N.W.T., Communication of October, 1980.

Kakisa Lake



KAKISA

SCALE - 1:8,000

N.A.P.L.
NO. A25371 - 7 15/7/79

Log houses in settlement

A. GENERAL

Kakisa is located on the west bank of Kakisa Lake by the Kakisa River. It has geographical co-ordinates of 60°57'N latitude and 117°02'W longitude. It is 240 km by air southwest of Yellowknife. The community is connected by an all weather gravel road to the Mackenzie Highway.

The community of Kakisa was established when the settlement at Tathline Lake moved to have closer access to the Mackenzie Highway in 1962. All of the residents are native people, mostly Dene Indians. The 10 or 12 buildings are made of logs taken from the surrounding area.

Kakisa Lake is an unorganized settlement. The community's population has remained fairly constant at about 40 people over the past few years.

Kakisa Lake is in a flat woodland area. There are few bedrock exposures although some bedrock can be seen along the Kakisa River.

The dominant form of vegetation is black spruce in the forests and mosses and scrub in the wetter areas.

The mean high and low temperatures for July are 24°C and 9°C respectively. Similarly, the mean temperatures for January are -22°C and -31°C. Precipitation consists of 146.1 mm rainfall and 1135.38 mm of snowfall. Prevailing winds are easterly at about 15 km/hr.

B. MUNICIPAL SERVICES

B.1 Water Supply

Water in the community is individually and manually obtained from Kakisa Lake. It is not treated in any way. This is an acceptable practice under current government policy since there are only 41 people in the community and the quality of water from the lake is adequate. During freeze-up ice is melted or water is obtained from beneath the lake ice.

B.2 Sewage Collection and Disposal

All of the residents rely on outhouses. They are built over pits which, when filled, are relocated as necessary. Greywater is deposited on the ground outside the residences. The soil profile in the area is sandy and conducive to absorption.

B.3 Solid Waste

The garbage dump is situated close to the community. Garbage is collected at undetermined intervals. The combustibles are burned and the remainder of the garbage is periodically backfilled and buried.

B.4 Roads and Drainage

One rough dirt track follows a circular route through the community. The road connecting Kakisa Lake with the Mackenzie Highway has an all weather gravelled surface. Surface drainage in the community is not a problem since the soil is sandy and drains well.

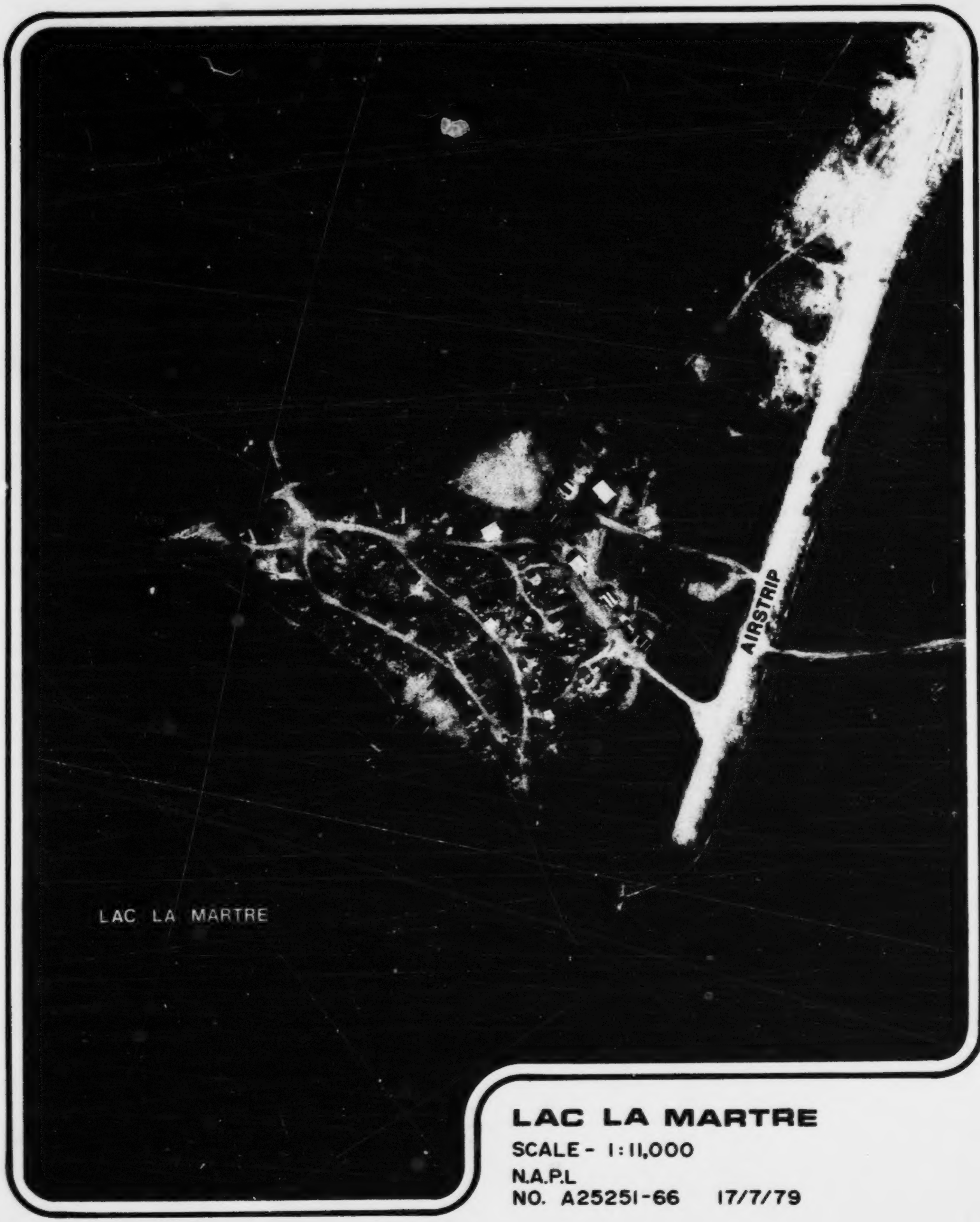
B.5 Fire Protection

Fire protection in Kakisa Lake consists only of fire extinguishers located in buildings designated as fire stations.

B.6 Other Services

There is a public campground located about 3 km from the community. Mail is picked up in Fort Providence. There is no electric power provided for Kakisa Lake.

Lac La Martre


AIRSTRIP
LAC LA MARTRE

LAC LA MARTRE
SCALE - 1:11,000
N.A.P.L
NO. A25251-66 17/7/79

Aerial view

A. GENERAL

A.1 Location

The settlement of Lac La Martre is 164 km by air northwest of Yellowknife. The geographical coordinates are 63°08'N latitude and 117°06'W longitude. The lake itself is about 80 km x 56 km in dimension.

A.2 History and Community Information

The Northwest Company established a permanent post at the site in 1793. A federal school was built in 1955. Lac La Martre now has settlement status.

The Dogrib Dene residents numbered 238 in 1980. The population has grown by 13 persons since 1977. Most families support themselves by hunting, fishing and trapping.

The community has a Roman Catholic church and community centre. Trading, health and R.C.M.P. services are provided in Rae, 112 km away by air. Access is via a winter road to the Mackenzie Highway or by air.

The clay and sand airstrip is 670 m x 21 m at 271 m A.S.L.

A.3 Geology and Terrain

The flat lying lowland on which the buildings are located is 2.5 m - 3 m above the shoreline. To the north, east, and south, marshy terrain predominates. Surface material consists of glacial or alluvial sand and silt. The bedrock is Palaozic-Ordovician sedimentary rock. The settlement has substantial sand and limited gravel resources. The active layer may have a depth of 0.5 m to 1.8 m. The settlement is located within the discontinuous permafrost zone.

A.4 Vegetation

The ground cover consists of grasses in and around the buildings. The surrounding forest has birch, willow, black spruce, and tamarack as well as numerous bushes, grasses and mosses.

A.4 Climate

The mean high temperature in July is 26°C and the mean low is 12°C. The January mean high and low temperatures are -33°C and -8°C respectively. Annual rainfall averages 127 mm and snowfall averages 1118 mm. Prevailing winds are easterly at 8.7 knots.

B. MUNICIPAL SERVICES

B.1 Water Supply and Distribution

Water is hauled from a lake approximately 2.5 km from the Hamlet to the residences. A wagon with a 2270 L (500 Igal) tank pulled by a skidder is used for transport. Water storage tanks in homes are aluminum or fibreglass.

B.2 Sewage and Solid Wastes

Most residents utilize outdoor privies. The school and government buildings have septic tanks.

Log houses in settlement

A community vehicle is used to collect garbage regularly. The waste is taken to an open dump. Water delivery and garbage collection is handled by the Settlement Council.

B.3 Roads and Surface Drainage

The rough dirt roads become muddy in inclement weather. Permeability of the soils in the cleared site is good and as such, drainage is not a problem.

B.4 Fire Protection

Extinguishers within the homes are the only form of fire protection in the community.

B.5 Other Services

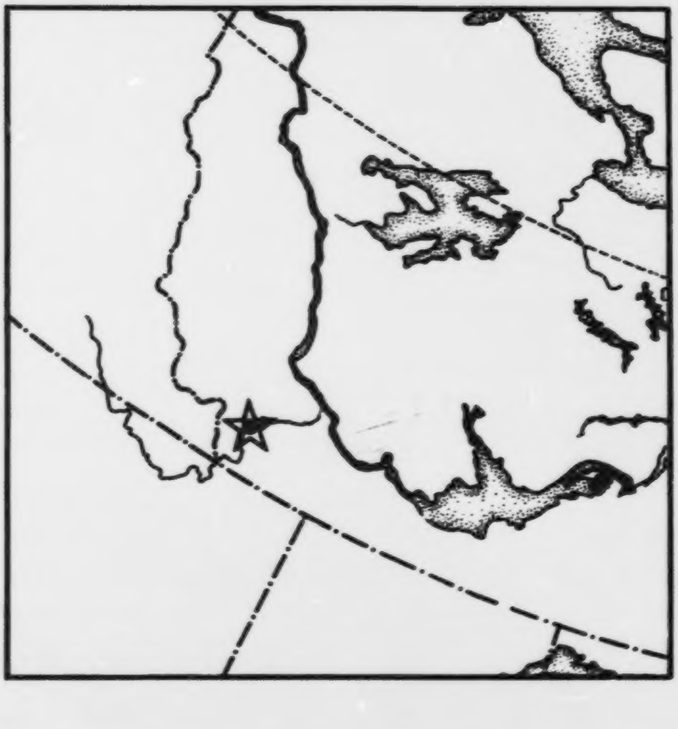
Lac La Martre has mobile radio telephone service and weekly mail delivery from Yellowknife, but no radio or television. NCPC provides diesel generated power.

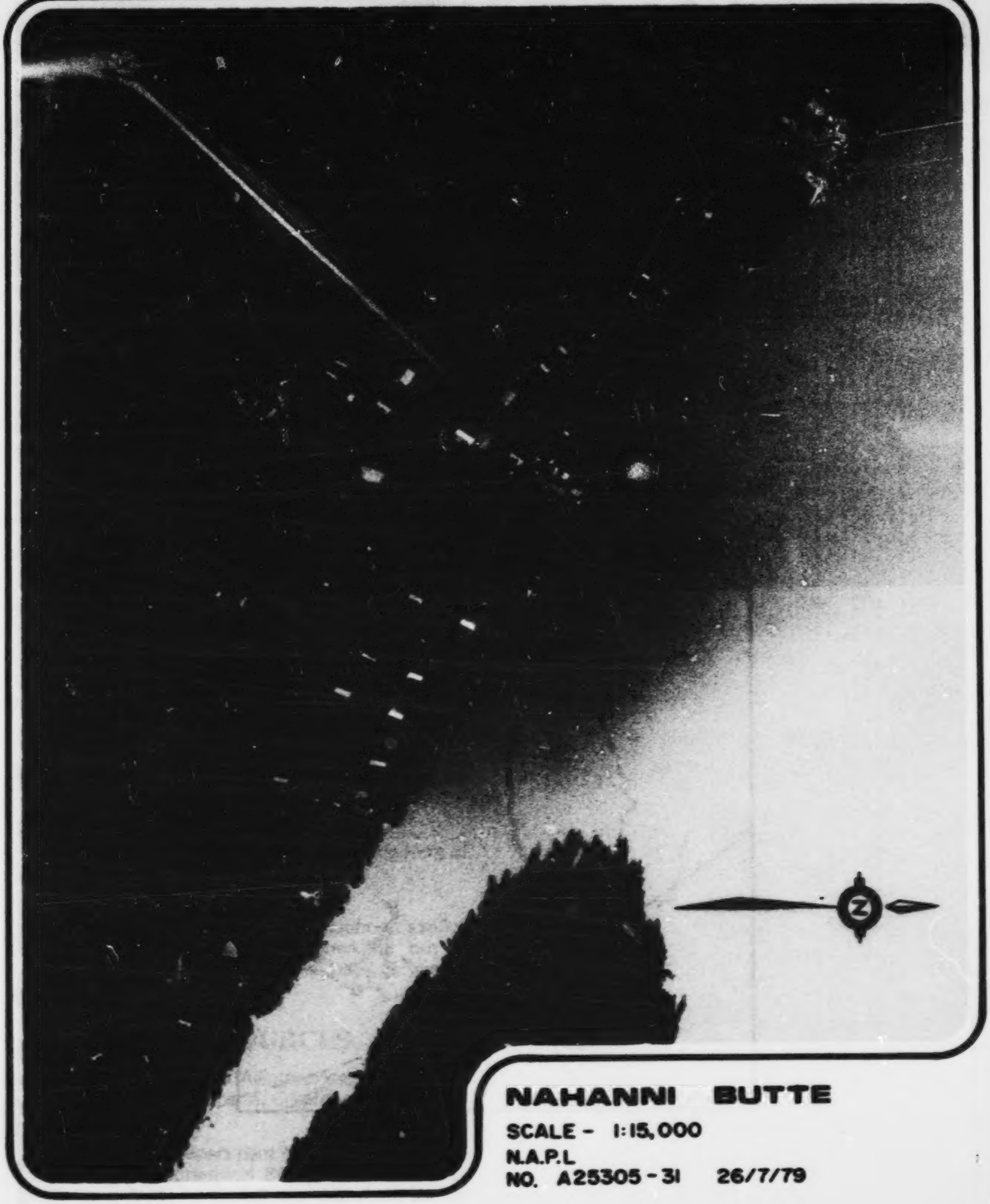
INFORMATION SOURCES

1. Ev Kinsman, Area Maintenance, Hay River, former AMO - Fort Simpson, Communication of October, 1980.

2. R. T. Gajda, Department of Mines and Technical Surveys, Geographical Branch, *Lac La Martre Settlement, N.W.T., Terrain and Site Analysis,* Ottawa, 1963.

Nahanni Butte





NAHANNI BUTTE

SCALE - 1:15,000
N.A.P.L
NO. A25305 - 31 26/7/79

A. GENERAL

Nahanni Butte is an unorganized community near the junction of the South Nahanni and Liard Rivers. Its geographical co-ordinates are 60°05'N latitude and 123°23'W longitude. The settlement is 142 km by air southwest of Fort Simpson and 507 km southwest of Yellowknife by air.

Nahanni Butte is a Slavey settlement. It is the access point to South Nahanni National Park and this is of economic significance to the settlement. Presently the economy is based on hunting, fishing and trapping.

The relatively stable population was 94 in 1980.

Freight is shipped into the settlement by boat via Fort Nelson, B.C. from mid May to mid August, or alternatively by air. The gravel and dirt airstrip is 762 m x 18 m. There are regular scheduled flights into the community.

All buildings are 30 m or more from the river bank on poor sandy, silty soil. Mountains rise in the distance behind the settlement. The river bank is eroding quite severely. The area is thickly wooded with spruce, birch and tamarack as well as numerous bushes and shrubs.

The July mean maximum temperature is 26°C and the mean minimum is 12°C. The January mean high and low temperatures are -23°C and -33°C respectively. Annual rainfall averages 381 mm and snowfall averages 1549 mm per year. The prevailing winds are northwesterly at an average speed of 8.7 knots.

B. MUNICIPAL SERVICES

B.1 Water Supply and Distribution

Water is hauled individually from a dug well 10.5 m deep at the school in summer. This well has a pump. The residents obtain water directly from beneath the South Nahanni river ice in winter.

Following is a chemical analysis of a sample collected from the school well in 1974 by Water Survey of Canada (DOE): (Values in mg/L unless otherwise noted)

Parameter	Value
pH	7.8
Alkalinity (as $CaCO_3$)	293
Hardness (as $CaCO_3$)	333
Calcium (Ca)	30
Iron (Fe)	0.4
Manganese (Mn)	0.34
Specific Conductance	295umho/cm
Turbidity	70 JTU

B.2 Sewage Collection

The school and government buildings have toilets and septic beds. The majority of the population utilizes pit privies.

B.3 Solid Waste

Garbage is burned by the residents as required. No organized pick-up service exists.

B.4 Roads and Surface Drainage

The road connecting the community with the airstrip becomes muddy in inclement weather. There is no road system within the settlement, only paths connecting buildings to each other.

B.5 Fire Protection

The only equipment available consists of fire extinguishers in homes.

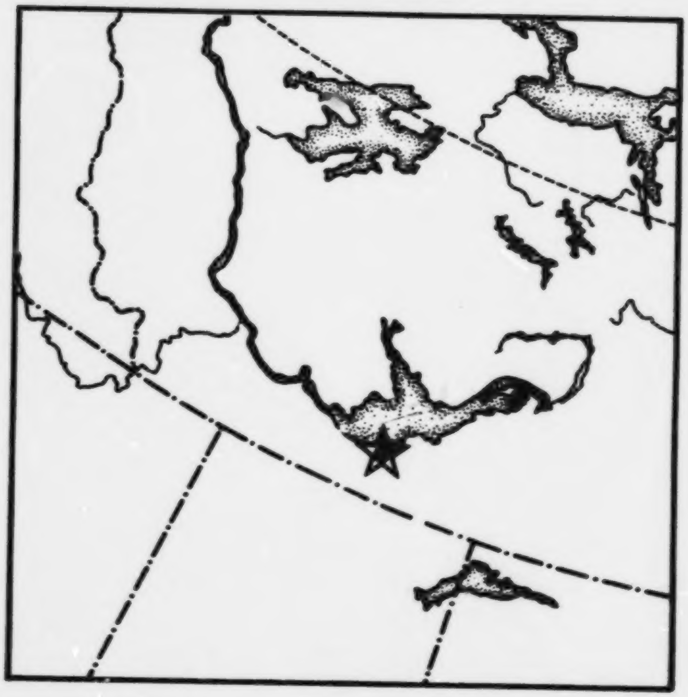
B.6 Other Services

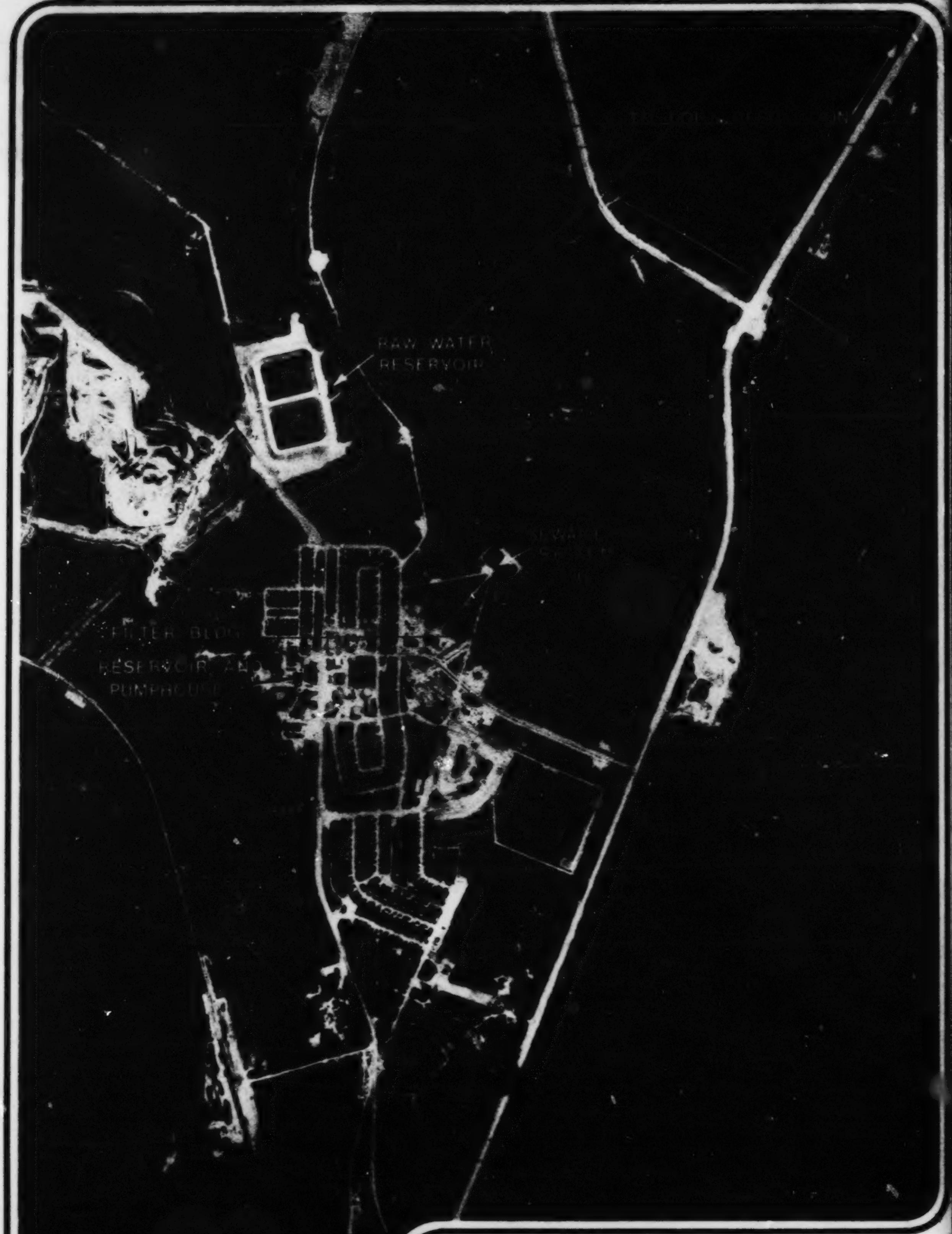
Nahanni Butte has a general store, school, and community centre. No television or radio services are provided.

INFORMATION SOURCES

Ev Kinsman, Area Maintenance, Hay River, Former AMO, Fort Simpson, Communication of October, 1980.

Pine Point

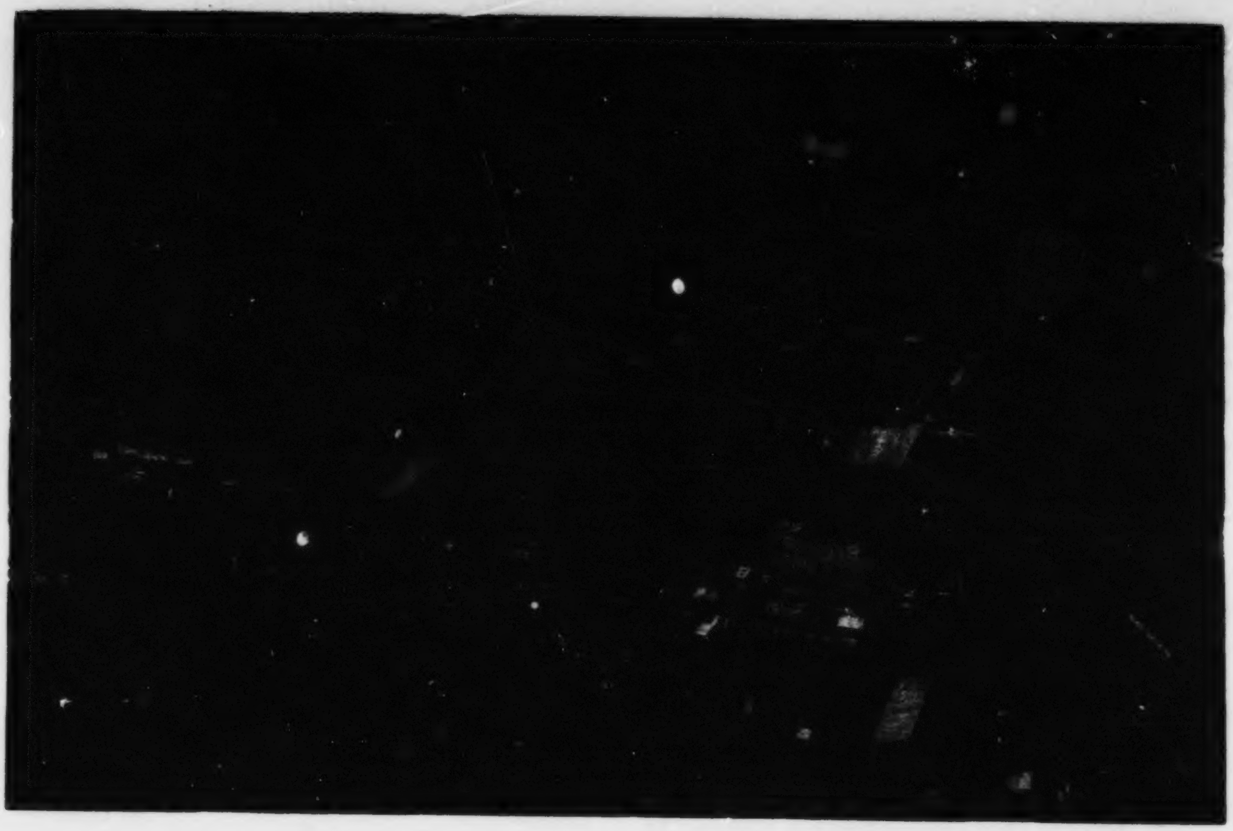



RAW WATER
RESERVOIR
FILTER BLDG
RESERVOIR AND
PUMPHOUSE

PINE POINT

SCALE - 1: 20,000

N.A.P.L.
NO. A25008-63 & 64 21/7/78



A. GENERAL

A.1 Location

The Town of Pine Point is located 10 km inland from the south shore of Great Slave Lake at latitude 60°50'N latitude and 114°28'W longitude. It is 80 air km east of Hay River and 190 air km south of Yellowknife.

A.2 History

Early fur traders taught Indians to use lead from local deposits to make fishing weights and shot. The Klondike Gold Rush drew prospectors up the Great Slave and Mackenzie Rivers enroute to the Yukon. Consequently, the first claims in the area were staked in 1889. These were allowed to lapse when the land yielded only minute amounts of gold and silver. The following year, Dr. Robert Bell of the Geological Survey of Canada visited the lead-zinc deposits and recorded a description of them. Further claims were staked in subsequent years and allowed to lapse despite positive reports from other members of the Geological Survey of Canada. Finally in 1928 an extensive program of churn drilling funded by various interests was begun at the future minesite. It was not until 1948 that further exploration work was carried out. Pine Point Mines Limited was formed in 1951 with Cominco holding a 78% interest. Ten years later, under the 'Roads to Resources' program, the Federal Government committed itself to funding a railway to the site. Cominco then proceeded to bring Pine Point Mines into production. The Townsite was finished and operations began in 1965, 67 years after the original staking.

A.3 Community Information

Pine Point obtained Town status in April of 1974. The mining community had a population of 1647 persons in 1980 which will soon be augmented by miners for the new underground operation and their families. Further population increases depend on non-Cominco related mineral development in the area and the potential influx of associated personnel.

Pine Point Mines is the major employer. Other jobs are generated by service industries, the Town, and the government. There is virtually no unemployment in the community.

The Town has good recreation facilities including an arena, curling rink, golf course and swimming pool. Education will soon be available through to Grade 12. A library, medical and dental clinic and various commercial establishments make Pine Point one of the better equipped communities in the Northwest Territories.

There are scheduled PWA flights from Hay River and Yellowknife. The gravel airstrip is 1372 m x 46 m and 224 m A.S.L. A paved highway connects Pine Point with Hay River. Freight service only is provided by C.N.R.

A.4 Geology and Terrain

The Townsite has been developed on a gravel ridge surrounded by low wet areas. The subsurface profile includes an extensive granular layer that becomes more silty with increasing depth. Clay till underlies the glacialy deposited material. Discontinuous permafrost may be found at depths below 1.5 m, though to date there have been no construction problems caused by permafrost conditions. Some difficulties have been encountered due to a high water table.

A.5 Vegetation

The Pine Point area is thickly wooded with black spruce, alder, willow and other hardy species.

A.6 Climate

The mean high temperature in July is 21°C. The mean low for the same month is 10°C. The corresponding January mean high and low temperatures are -20°C and -30°C respectively. Average annual rainfall is 184 mm and snowfall averages 1354 mm. Prevailing winds are northeasterly at about knots on average.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Cominco Limited designed and installed the original piped water system and treatment facilities. Two 76 m wells drilled in 1963 were replaced in 1968 by 134 m and 152 m deep wells, each with a 40 HP, 2275 L/min (500 Igpm) pump. Raw water storage consisted of a 136 400 L (30 000 Igal) wood stave tank. After softening, water was stored in a 48 200 l (106 000 Igal) wood stave tank. Two 7-1/2 HP, 455 l/min (100 Igpm) pumps circulated water through the wood stave distribution piping.

In 1972, Cominco installed a reverse osmosis facility supplied by Polymetrics of Santa Clara, California, to upgrade the well water quality. Within 5 years the unit was overloaded. The domestic water supply had a pH below 6 causing corrosion of the iron pipes. Another problem concerned an unacceptable concentration of H_2S in the drinking water. Deterioration of the well water quality with respect to hardness, dissolved solids and sulphates over the years culminated in the construction of a lake water intake in 1978. A new dual celled reservoir stores raw water. The reverse osmosis facility was dismantled and replaced by sand filters. Well water, however, is still used for irrigation of the baseball diamond.

The domestic water supply and distribution facilities now consist of the following:

1. intake and pumphouse at Triangle Point on Great Slave Lake;
2. booster pumping station along the new water pipeline;
3. earthen two-celled raw water reservoir;
4. reservoir pumphouse and pipeline to the treatment plant;
5. treatment plant with pressure sand filters;
6. treated water storage in the finished water reservoir;
7. chlorination prior to pumping through the distribution piping; and
8. pumps for water distribution.

Great Slave Lake is now used as a year round source of water. The intake pipeline was designed to operate during the summer only, with sufficient water being stored in the raw water reservoir to supply the Town's winter requirements. Breaks in the pipeline and higher than anticipated water usage have precluded the designed method of operation and lake water now has to be pumped during the winter months.

B.1.2 Source

Following is a chemical analysis of a sample collected of Great Slave Lake water at Triangle Point near the present intake. It was collected by DIAND, Water Resources on November 8, 1977. (All values in mg/L unless otherwise noted)

Parameter	Value
pH	6.4
Specific Conductance	189 umho/cm
Turbidity	30 JTU
Colour	60 Units
Alkalinity (as $CaCO_3$)	80
Hardness (as $CaCO_3$)	123
Calcium (Ca)	32
Sodium (Na)	8.0
Chloride (Cl)	7.0
Iron (Fe)	0.26

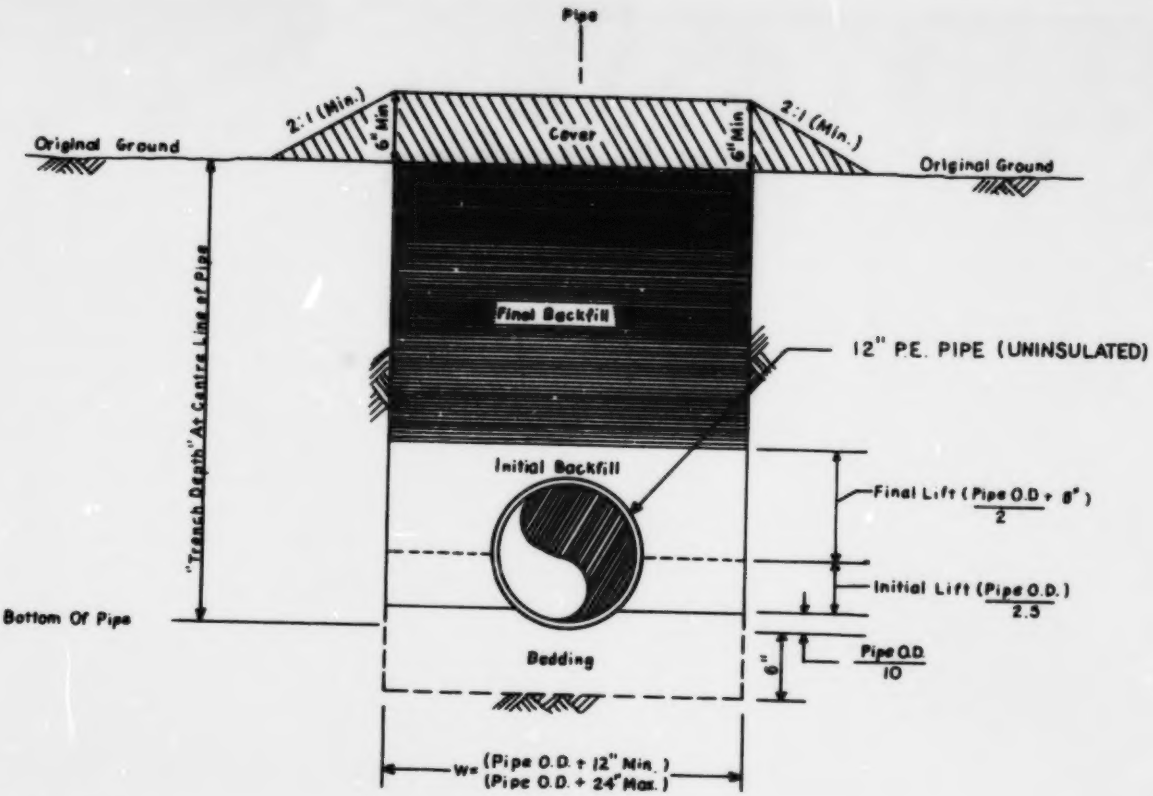
B.1.3 Intake Facilities

The pipe into Great Slave Lake consists of 259 m of 350 mm diameter series 45 high density polyethylene pipe. Approximately 30 m of the lake pipe adjoining the wet well is insulated with 50 mm of polyurethane covered with a 45 mil high density polyethylene jacket over 10 mil butyl rubber sealant. The pipe is weighted by 113 kg concrete blocks at 3 m intervals.

The raw water intake frame is constructed of steel plate and sections covered with 16 gauge steel wire woven in a 6 mm mesh and welded over the frame openings and is 1.5 m under water.

Raw water is pumped into a 1060 mm diameter 9.75 m epoxy coated pipe acting as a wet well. Two 70 HP submersible pumps, one of which will be replaced by a 100 HP pump, alternate to pump 3410 L/min (750 Igpm) through the 1.51 km raw water line to the reservoir.

The intake pipeline of 300 mm diameter Series 45, 60, 70, 100 or 125 polyethylene pipe is buried 1.2 m below grade from the intake pumphouse to the reservoir. A standpipe open to the atmosphere above the hydraulic grade line in the pipeline is in-


Pipe
2:1 (Min.)
6" Min
Cover
6" Min
2:1 (Min.)
Original Ground
Original Ground
"Trench Depth" At Centre Line of Pipe
Final Backfill
12" P.E. PIPE (UNINSULATED)
Initial Backfill
Final Lift (Pipe O.D + 6") / 2
Initial Lift (Pipe O.D.) / 2.5
Bottom Of Pipe
Bedding
6"
Pipe O.D. / 10
W= (Pipe O.D. + 12" Min.) (Pipe O.D. + 24" Max.)

Intake pumphouse

tended to handle surges and admit air when the pipeline is drained for winter. The pipeline is neither insulated nor heat-traced. Temperature monitoring stations, Atkins Model 10513 (P51-3) were designed to monitor pipe temperatures.

Problems with poorly butt fused joints during construction necessitated expensive repairs when a number of the joints later failed. Bolted collars were used to rejoin the pipe.

A booster pumping station was built in 1979, 9373 m from the intake pumphouse.

B.1.4 Raw Water Storage

The raw water reservoir, completed in 1978, has a capacity of 480,000 m³. It is located 0.8 km east of the Town, bounded by the airport road on the south and the mine road on the north. Each of the two cells is lined with a CPE impervious membrane. It is individually valved, and is equipped with separate inlet and outlet structures.

Each cell measures 230 m x 192 m (240 000 m³) and has interior side slopes of 3:1. The liner on the sides is covered by 1.2 m of protective coarse granular material.

A 150 mm Series 45 insulated HDPE buried pipe carries raw water, pumped through the reservoir facilities, 933 m to the water treatment building in Town.

Raw water reservoir

B.1.5 Treatment

Primary settling occurs in the raw water reservoir. The reservoir pumping station pumps water through four sand filters in parallel in a building that formerly housed the reverse osmosis facility. The water then continues to a covered 4.55 million L (1 million Igal) reservoir next door. The treatment system is designed to supply water to this reservoir at a peak rate of 25 L/s. Prior to distribution, the filtered water is gas chlorinated as it passes through the main pumphouse.

B.1.6 Pumping Facilities

There are pumps at four locations; the intake pumphouse, the booster pumphouse, the raw water reservoir pumphouse and the treated water distribution pumphouse.

Intake Pumphouse

Function: Intake pump
Type: Submersible vertical turbine
Number: 2
Model: Pleuger Q82-4
Capacity: 31.5 L/s @ 1045 kPa (416 Igpm @ 350') TDH
Motor: 70 HP, 3500 RPM, electric

Booster Pumping Station

Function: Booster Pump
Type : Submersible vertical turbine
Number: 2
Model: Pleuger Q82-2 (18" diameter casing)

Reservoir Pumphouse

Function: Pumps to Distribution Pumphouse
Type: Horizontal centrifugal
Number: 2
Motor: 1750 RPM

Distribution Pumphouse

1. Function: Distribution pump
Number: 3
Model: Weinman BI-8
Capacity: 1137 L/m (250 Igpm)
Motor: 10 HP

Distribution pumphouse and storage reservoir

2. **Function:** Maintain water pressures (ie., fire flow)
Capacity: 113.7 L/s (1500 gpm)
Motor: Diesel, 220 HP

B.2 Water Distribution

Potable water is pumped through three distribution loops. The original residential part of Town has 2440 m of wood stave pipe. Another area of the older part of Town towards the east has 2290 m of ductile iron pipe. The more recently developed areas to the west have 2440 m of ductile iron pipe. All pipe is 150 or 200 mm in diameter and uninsulated.

During the coldest months a diesel-run boiler heats water to send through the distribution recirculating network. Two Weinman 1-1/2 HP, 136 L/min (30 Igpm) recirculating pumps are used for this purpose.

B.3 Sewage Collection

Pine Point has a gravity system of 150 mm and 200 mm buried wood stave and vitrified clay tile sewers. There are three 255 mm outfalls into a sewage lagoon.

B.4 Sewage Treatment

The two celled lagoon is situated approximately 365 m southeast of Town behind the raw water reservoir.

The main cell is rectangular in shape (117 m x 46 m), 1.8 m deep, and has a total volume of 10.9 million L (2.4 million Igal). Raw sewage is discharged at a depth of 1.5 m on one of the long sides into the lagoon. Effluent from this cell discharges through another 255 mm pipe directly across from the intake to a 205 m x 15 m drainage channel with a total capacity of 3.25 million L (714 000 Igal). The primary treated sewage eventually makes its way through swampland to Great Slave Lake. The lagoons may be considered to be operating somewhere between facultative and anaerobic ponds. An additional cell is being considered for expansion and improvement of the treatment system.

B.5 Solid Waste Collection and Disposal

Solid wastes are collected three times per week under contract from the Town. The dump is 1.6 km east of the community. The area is well maintained. A bulldozer pushes garbage to the end of a fenced enclosure. Wastes are buried and/or burned in winter.

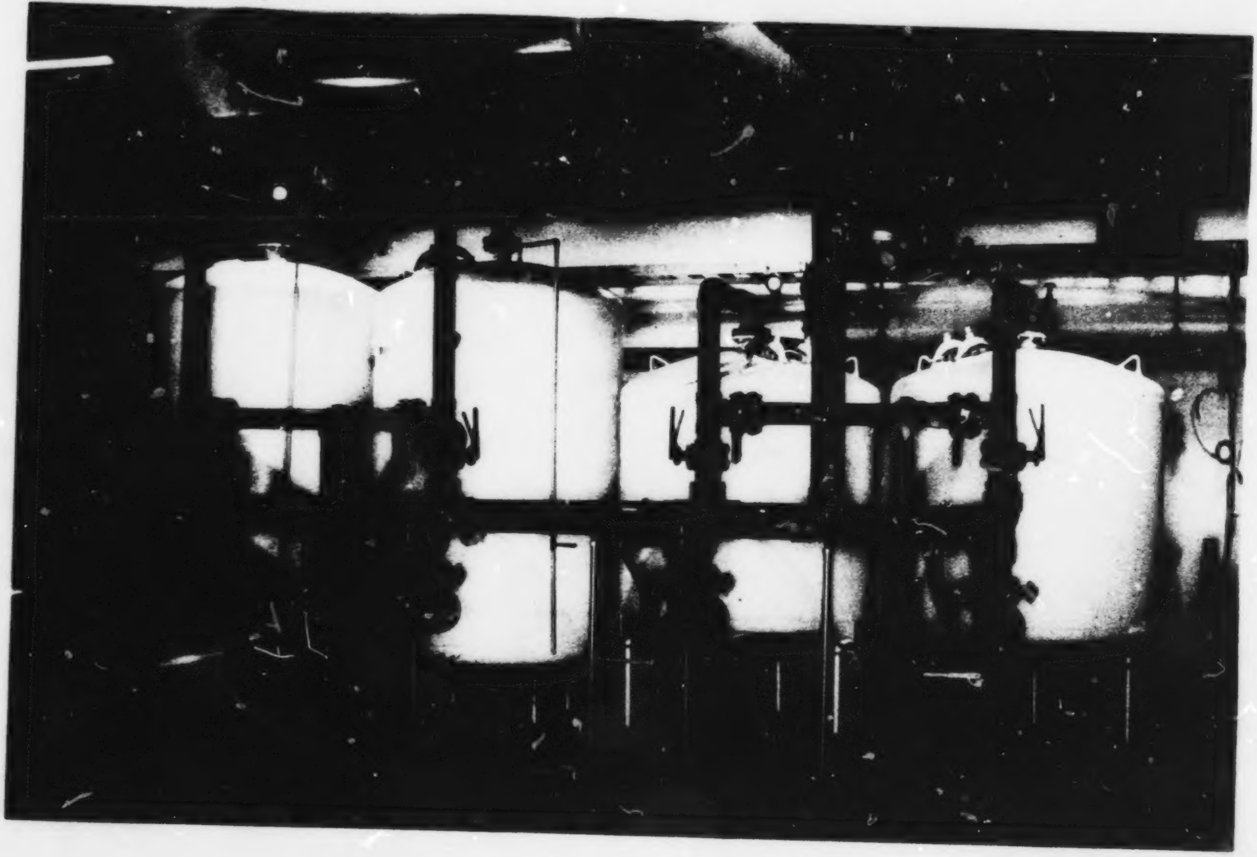
B.6 Roads

All of the collector and residential streets of Pine Point are paved although there are no curbs or sidewalks. These roads, as well as the gravel roads on the Town periphery, are in good condition.

B.7 Surface Drainage

Townsite drainage is handled by roadside ditches and natural drainage with the exception of the extreme southeast part of Town which has a small

Sand filters at treatment plant



storm sewer system. The runoff is directed to low marsh areas within the Town. The percolation rate into the underlying sand and gravel is high, eliminating most drainage problems.

B.8 Fire Protection

Fire hydrants are located throughout the community. A 150 mm shallow buried recirculating non-insulated HDPE water line, specifically for fire fighting purposes, was recently installed in some parts of the Town with wood stave piping.

The Town owns a fire truck which is kept in a hall adjoining the Town office. The mine's firefighting equipment would supplement that of the Town in the event of a serious fire.

B.9 Other Services

Telephone service is provided by C.N.T. and the community has CBC television and radio service. Mail is distributed daily. Electricity is provided by NCPC and is generated from the Taltson hydroelectric plant.

Garbage dump

INFORMATION SOURCES

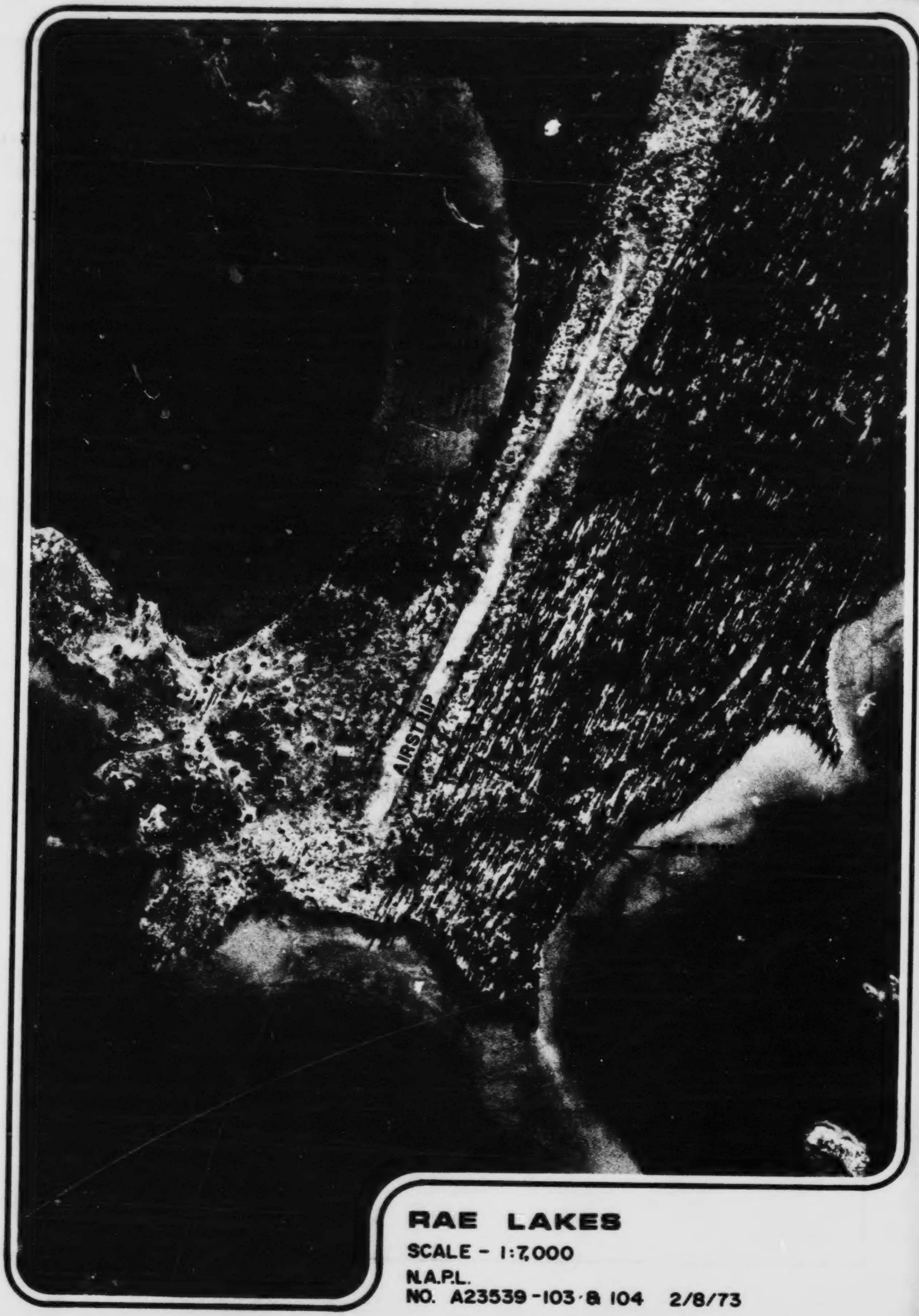
1. Stanley Associates Engineering, *The Town of Pine Point, N.W.T., Townsite Development Study,* January, 1976.

2. Reid, Crowther & Partners Ltd., *Preliminary Report on Water Supply and Treatment, Town of Pine Point, N.W.T.,* April, 1970.

3. Tex McDougall, Town of Pine Point Works Foreman, Conversations of August 12, 1980.

4. M.M. Dillon Ltd., Consulting Engineers, *Operations and Maintenance Manual - Potable Water Supply, Treatment and Storage System for Pine Point, N.W.T.,* October, 1978.

Rae Lakes



RAE LAKES

SCALE - 1:7,000

N.A.P.L.
NO. A23539-103 & 104 2/8/73

A. GENERAL

Rae Lakes is a small native community 177 km by air northwest of Yellowknife. Its co-ordinates are 64°09'N latitude and 117°20'W longitude.

The Dogrib Dene used the site on the shore of Rae Lake as a hunting camp in past years. In the early 1970's it became a more permanent settlement with the construction of a community hall, teacherage, store, homes and an airstrip. The sand airstrip at 213.4 m A.S.L. is 853 m x 30 m.

Rae Lakes had a population of 178 in 1980, an increase of 6 over the previous two years. The natives support themselves by fishing and trapping. The children attend primary school in Rae Lakes and then are sent to Rae-Edzo's Territorial school. Mail arrives once a week on the regularly scheduled flight from Yellowknife. The settlement communicates with the outside world by C.N.T. mobile radio telephone. A winter road connects Rae Lakes with the Mackenzie Highway by Fort Rae.

Tree cover in the area generally consist of Black Spruce, poplar and willow.

Prevailing winds are easterly at an average of 8.7 knots. The mean annual snowfall is 1118 mm and rainfall averages 127 mm per year.

B. MUNICIPAL SERVICES

B.1 Water Supply

Water was traditionally hauled from the lake by each family. In the winter a hole was cut through the ice 1.5 to 3 m from the end of the dock. In 1977 a water intake line was finished. It was designed as a pumped summer water supply. The residents may fill their containers at 11 water points throughout the community though some continue to take their water directly from the lake.

B.1.1 Source

A 1977 water analysis indicates that Rae Lake is of good chemical quality. The following sample was taken on June 16 by G.N.W.T.

Chemical Analysis (NOTE: All values in mg/L unless otherwise indicated)

CONSTITUENTS	VALUES
pH	8.2
Suspended solids	10
Colour	10 Units
Total alkalinity (as $CaCO_3$)	93.4
Total Hardness (as $CaCO_3$)	142
Calcium (Ca)	38
Potassium (k)	1.5
Sodium (Na)	4.5
Chloride (C1)	5
Sulphate (SO_4)	42
Total Iron (Fe)	< 0.04

Aerial view

Water point

B.1.2 Intake Facilities

The intake consists of a submersible pump protected by a 200 mm perforated pipe which is set in a 205 L (45 Igal) drum filled with rocks. The bottom of the drum is about 4.5 m below the lake's surface and 150 m from shore.

The pump is a Monarch Model #7-75SP with a 3/4 HP, 230V, single phase motor. A 50 mm polyethylene Sclairpipe acts as the distribution line. A Well-Xtrol Tank is connected to the main line by a 25 mm Sclairpipe. The pressure tank and pump are removed each fall and the shallow buried pipes must be blown out with compressed air.

B.2 Water Distribution

The main 50 mm pipe branches off within the settlement to 11 water pail stations. These are 0.6 m square log rock-filled boxes each with a 20 mm (3/4") galvanized pipe and water tap fastened to the boxes for stability.

B.3 Sewage Collection and Disposal

Sanitation facilities are very basic in Rae Lake using outdoor privies. The school uses bagged sewage facilities.

B.4 Solid Waste Collection and Disposal

Garbage is collected by the Council and disposed of at a dump near the end of the airstrip.

B.5 Roads and Surface Drainage

Roads generally consist of trails which have been upgraded through maintenance and surfacing. Drainage is over land and does not pose serious problems.

B.6 Fire Protection

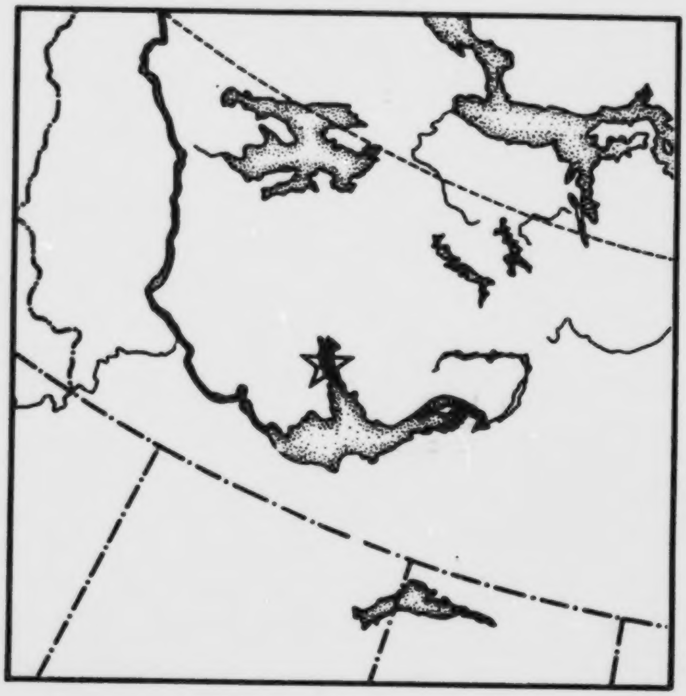
The fire-fighting equipment consists of fire pumps, hoses and extinguishers.

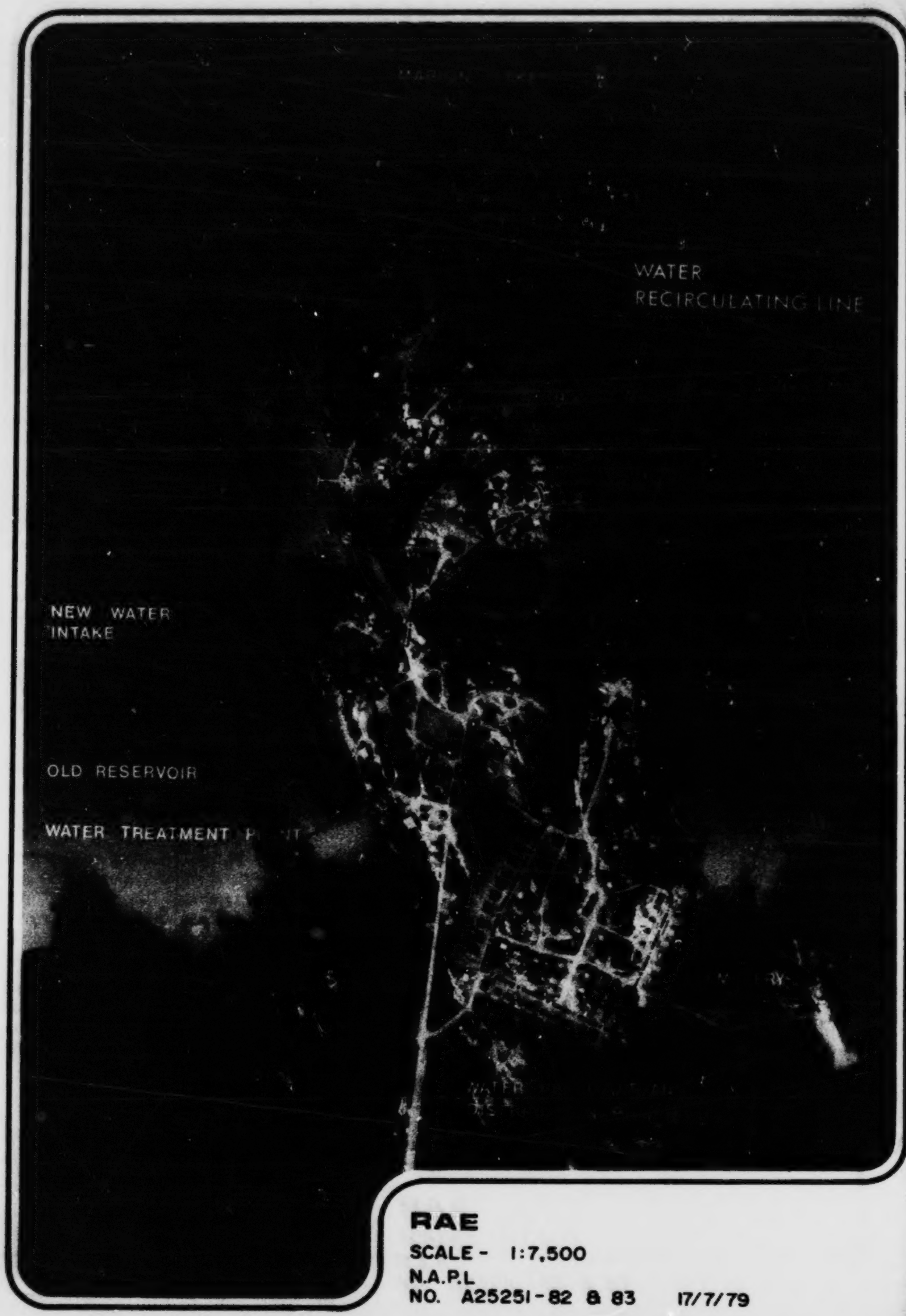
INFORMATION SOURCES

1. Bob Pringle, Project Officer, Project Management Division, D.P.W., G.N.W.T., *Letter to Bob Scott, Operations and Maintenance, D.P.W.,* August 30, 1977.

2. F. James, Project Manager, Project Management Division, D.P.W., G.N.W.T., *Report on visit to Rae Lakes of October 15, 1976,* October 26, 1976.

Rae-Edzo




WATER
RECIRCULATING LINE
NEW WATER
INTAKE
OLD RESERVOIR
WATER TREATMENT PLANT
WATER

RAE

SCALE - 1:7,500
N.A.P.L
NO. A25251-82 & 83 17/7/79

Water points

A. GENERAL

A.1 Location

Rae (Rae-Edzo), the largest Indian settlement in the Northwest Territories, is located at latitude 62°50'N and longitude 116°4'W. The community is on a rocky peninsula on the southeast shore of Marian Lake, part of the north arm of Great Slave Lake. Buildings are scattered over a portion of the mainland and two islands connect to it by short bridges.

Yellowknife is approximately 115 km to the northwest via the Mackenzie Highway.

A.2 History

The Hudson's Bay Company established a trading post on Fort Island in Great Slave Lake in 1852. The fort was named in honour of Chief Factor John Rae. Then at the turn of the century, the Northern Trading Company set up a post at the present site of Rae; the point where travel routes from traditional hunting areas converged. With their supply of fur effectively cut off, the Hudson's Bay Company decided to relocate Fort Rae in 1904.

Natives of the Dogrib Tribe pitched their tents temporarily to trade, fish and hunt in the area before moving on. It was not until the 1940's that permanent residences were built. In 1958, electricity was brought to Rae. The access road to connect the settlement with the Mackenzie Highway was constructed one year later.

Growth continued unchecked during the next decade. Unsuitable water and sanitation soon led to illness amongst the native population. A decision was made to relocate the community to a more suitable site 6 km by water from Fort Rae. A construction freeze initiated in 1971 in the parent community was lifted four years later so Rae continues to grow at the expense of Edzo, its twin community.

A.3 Community Information

The twin community of Rae-Edzo achieved Hamlet status in April, 1971. From a population of about 500 in the mid 1960's, the number of residents swelled to 1314 in 1980. About 1100 still live in Rae.

Among the establishments in Rae are the R.C.M.P., a restaurant, the Hudson's Bay store, a handicraft co-operative, the Roman Catholic mission, a new community centre, a medical clinic and two trucking companies. Key facilities, such as the hospital and territorial school are located in Edzo, 24 km away by road.

A taxi service operates in Rae. There are regular flights to the community using float or ski equipped aircraft which can operate from the Lake.

A.4 Geology and Terrain

The low lying area of Rae is characterized by outcrops of precambrian granitic rock and wet lowlands of sedimentary sand, clay and silt material. The soil depth within the community is very shallow. The water level of Marian Lake by the Hamlet was measured as being 157 m above sea level in 1976. The highest point of the site is 163 m.

Due to high moisture content in the area's alluvially deposited soils under discontinuous permafrost conditions, ice lenses and frost-heaving result, leaving non-rocky areas unsuitable for building upon without expensive remedial measures.

Gravel and sand are currently obtained from a source near Russell Lake, 24 km away.

A.5 Vegetation

The ground cover within the Hamlet consists of grasses, lichens, low bushes and small willow and birch trees. Behind the Hamlet, land is heavily forested with spruce, willow, jack pine, white poplar, alder and other species typical of the Boreal forest zone.

A.6 Climate

The seven month winters last from October to April with a mean daily temperature of -30°C in January. The summers from June to August are cool, with a mean daily temperature of 16°C in July. The mean frostfree period is 113 days. Ice forms on the lakes in October and leaves in early June.

The average annual precipitation is about 250 mm of which 60% falls as rain. Prevailing winds are from the north and east.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

For years the natives simply used buckets to haul water from Marian Lake. A water treatment plant began operation in 1965. Water was pumped from a roughly 50 m square portion of the lake enclosed by dykes through an insulated pipe to the plant. After filtration, softening and chlorination, the water was stored in a 19 100 L tank. Water was trucked to most residences from the water treatment plant save for the cafe and residence, the R.C.M.P. buildings, four trailers and the hospital which has since been closed. A utilidor system served the latter buildings. Storage was eventually upgraded to 22,730 L (5000 Igal).

Many natives disliked the taste of the chlorinated water and continued to take their water from the polluted lake. Serious epidemics of gastro-intestinal diseases occurred. A medical officer of health ordered that use of the water treatment plant be discontinued and in 1971 water was trucked for a time from the well in Edzo. Residents complained about the harder water and continued to haul water from the contaminated lake. Use of the water treatment plant resumed with no additional treatment provided.

Recent improvements have been made to the water supply system. The water intake was extended further out into the lake. A new concrete reservoir and distribution pumphouse were under construction in 1980/ 81 and two water mains were installed. Those residents who do not have pressurized water supply to their homes, or trucked water delivery, obtain water from taphouses supplied by a 75 mm main.

B.1.2 Source

Marian Lake is shallow, less than 1.5 m deep, adjacent to Rae, and subject to pollution by run-off from the community. The water is of acceptable chemical quality, however as shown by the following analysis: (All values in mg/L unless otherwise noted)

Parameter	Value
pH	7.0
Specific Conductance	60.3 umho/cm
Colour	20 units
Alkalinity (as $CaCO_3$)	24.4
Hardness (as $CaCO_3$)	31.2
Calcium (Ca)	8.0
Potassium (k)	0.9
Iron (Fe)	0.1
Sodium (Na)	1.1

(DIAND Water Resources, sampled April 19, 1977)

B.1.3 Intake Facilities

A 200 mm intake pipe was extended 846 m into the lake in 1979, such that the intake is now in a channel with deeper flowing water. The pipe is Series 100 HDPE. Concrete weights are spaced at 1.5 m intervals. The intake screen is made of 10 mm bars @ 25 mm centers covered with 6 mm diamond mesh strapped to the bars.

Water is pumped from the wet well at the old reservoir to the water treatment plant close by.

B.1.4 Treatment

The water treatment plant, by the shore of the lake, is a Waterboy WB 82 package plant. Treatment facilities include a flocculator, tube settler, mixed media filter and hypochlorinator.

Treated water is stored in a 22 700 L (approximately 5000 Igal) holding tank. It will be transferred via a 150 mm water main to the new concrete reservoir and distribution pumphouse when construction is completed.

B.1.5 Storage

The new concrete reservoir has a capacity of 500 000 L for treated water. The covered reservoir has two cells each with dimensions of 5 m x 10 m x 5.5 m high.

B.1.6 Pumping Facilities

Raw Water Intake

Function: Pump lake water from wet well

to water treatment plant
Type: Submersible turbine, electric motor
Number: 2
Capacity: 3.8 L/s @ 11.52 m TDH (50 igpm @ 38 ft. TDH)

Water Treatment plant

1. **Function:** To pump treated water to reservoir pumphouse
Type: end suction centrifugal - electric motor
Number: 2
Capacity: 3.18 L/s @ 28.75 m TDH (42 igpm @ 94 ft. TDH)

New Pumphouse

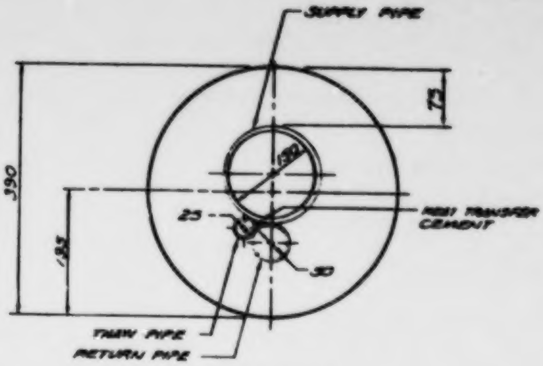
The pumphouse at the new reservoir will contain 3 pumps as follows:

1. Duty pumps (2 - one standby)
Capacity: 4.4 L/s @ 38.1 m TDH (58 igpm @ 125 ft. TDH)

2. Fire Pump (1)
Capacity: 42.9 L/s @ 38.1 m TDH (566 igpm @ 125 ft. TDH)

B.2 Water Distribution

B.2.1 Piped System



WATER MAIN
SCALE 1:3

The supply main carrying treated water to the distribution pumphouse consists of 150 mm HDPE pipe, a 50 mm HDPE return pipe and a 25 mm thaw tube all enclosed with polyurethane insulation and a Yellow Jacket.

Taphouses with a faucet provide access to the watermain for the majority of residents without service connections. These 19 taphouses are regularly spaced along the 75 mm polyethylene line which loops through much of the community (see aerial photo).

B.2.2 Trucked System

Newer homes have generally been equipped with 1140 L (250 Igal) water tanks. In 1977, Rix Trucking

View of portion of community

had the contract to deliver 272 800 L (60 000 Igal) per month. There were two haulage trucks with 5455 L (1200 Igal) and 8180 L (1800 Igal) capacities. Water will be trucked from the treatment plant until the new truck fill point at the distribution pumphouse is completed.

B.3 Sewage Collection
It is the policy of the Housing Corporation to install sewage pumpout tanks in all new housing, however, the majority of the population still uses bucket toilets.

The sewage pumpout service is contracted locally. In 1977, it served 12 units. The truck has a tank capacity of 545 L (2000 igal).

Bagged sewage pickup is carried out under local contract. Approximately 100 units were serviced 6 or 7 times per week in 1977. An open box truck is utilized to collect the waste.

A Honeybucket Recycling Facility is planned for Rae. Waste buckets will be collected, then dumped and cleaned at the pailhouse. All sewage will be hauled by truck to the lagoon.

B.4 Sewage Disposal
Bagged and liquid sewage are hauled to a single cell long-retention lagoon about 2 km east of Rae adjacent to the access road.

The present lagoon size is estimated at 68 million litres. A second lagoon with a volume of 90 million litres will be developed as the need arises.

B.5 Solid Waste Collection and Disposal
Garbage is collected from barrels on low wooden stands in front of houses. It is hauled to a dump 2.5 km along the access road from the Hamlet. A wooden pole fence screens the area from the road. Periodically the garbage is covered with fill and burned in the winter.

B.6 Roads and Drainage
The access road from the Mackenzie Highway is gravel surfaced and in good condition. They were constructed of gravel or other fill material laid over bedrock. A few wooden sidewalks have been laid over wet sections.

Poor drainage exists due to the rock ground surface and the problem is compounded by road construction. Ponding occurs where culverts were not installed. No ditch drainage system exists.

B.7 Fire Protection
An annunciation panel is connected to 15 call boxes throughout the community. A 1966 standard triple combination pumper and 12 volunteers are available to fight fires.

B.8 Other Services
The Hamlet of Rae has a telex unit, telephone service by C.N.T., CBC radio from Yellowknife, daily postal service, and television. NCPC provides power from the Snare River Hydro Development.

INFORMATION SOURCES

1. Reid Crowther & Partners Limited, *Preliminary Engineering Report for a Development Plan for Rae in the Hamlet of Rae-Edzo, N.W.T.*, June, 1977.

2. Jack Grainge, Regional Engineer, Department of National Health and Welfare, *Environmental Conditions and the Proposed Development of Rae Edzo, N.W.T.*, Edmonton, March, 1977.

3. Rockliff Partnership/Architects/Planners, *Rae Tomorrow - A Development Plan*, March, 1978.

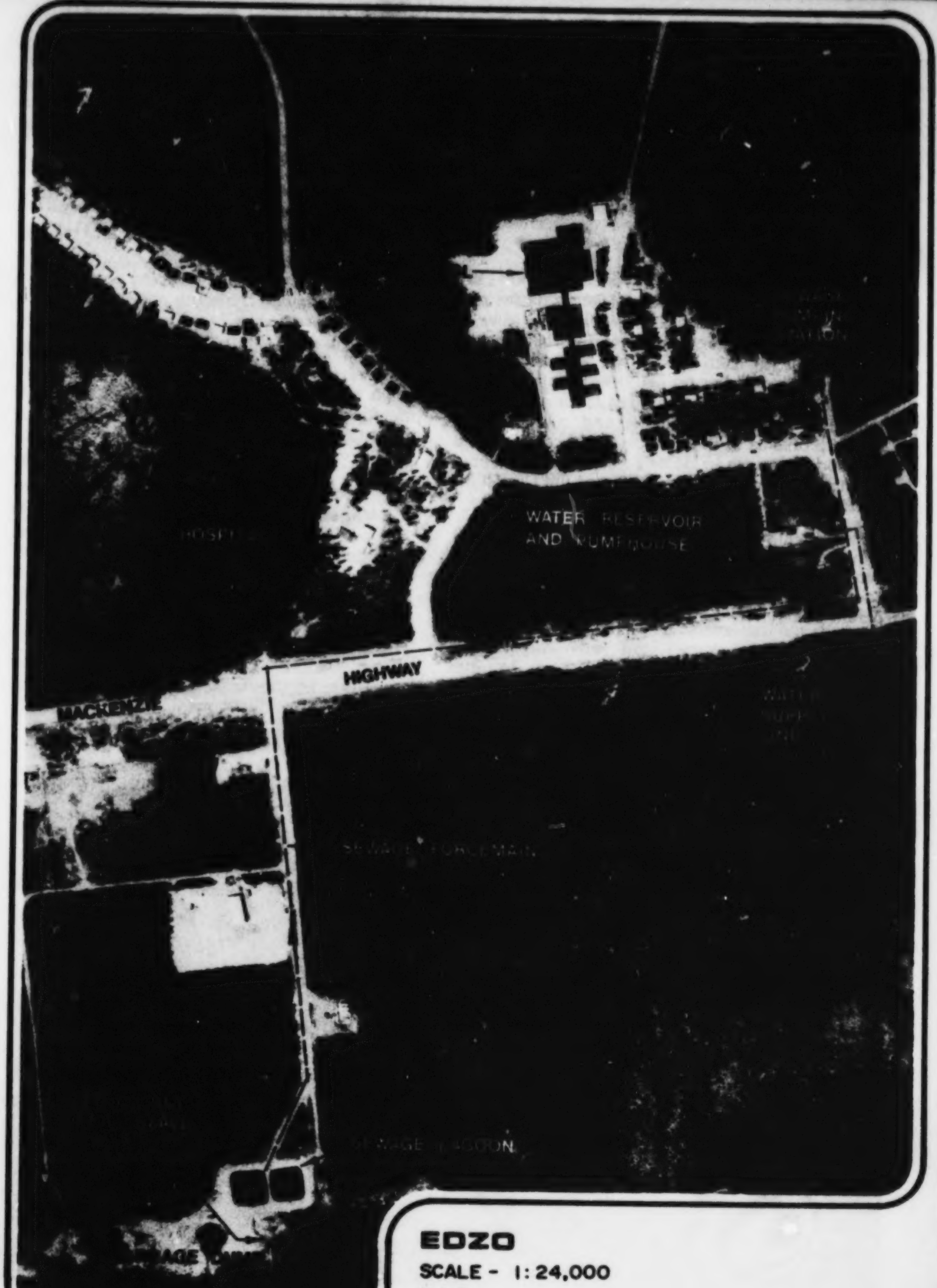
4. Department of Public Works, Project Management Division, G.N.W.T., *Fort Rae Sewage Lagoon Improvements*, February, 1981.

5. Department of Public Works, G.N.W.T., *Construction of Water and Sewer Servicing, Stage I Specifications, Rae Townsite, N.W.T.*, May, 1978.

6. Department of Public Works, G.N.W.T., *Construction of Water and Sewer Servicing, Stage II Specifications, Rae Townsite, N.W.T.*, May, 1979.

7. Department of Public Works, G.N.W.T., *Water Storage Reservoir and Pumphouse Specifications, Rae, N.W.T.*, May, 1980.

8. Department of Public Works, G.N.W.T., *Specifications for Construction of Water Intake, Rae Townsite, N.W.T.*, November, 1978.


WATER RESERVOIR
AND PUMPHOUSE
HIGHWAY
MACKENZIE
SEWAGE FORCEMAIN
SEWAGE LAGOON

EDZO

SCALE - 1: 24,000

N.A.P.L
NO. A24143-71 8/7/75

A. GENERAL

A.1 Location

Edzo, of the twin settlement Rae-Edzo, is located at 62°40'N latitude and 116°4'W longitude. It is 24 km by road from Rae down the Mackenzie Highway, or 6 km by water. The community is bounded on the east by West Channel which flows between Marion Lake and Great Slave Lake. Yellowknife is only 106 km from Edzo.

A.2 History

The established settlement of Rae, on Marion Lake for many years had been experiencing health problems including gastrointestinal diseases, due to poor water and sewage facilities. The rocky terrain did not lend itself easily to a conventional underground piped water and sewer system. It was felt that any further development at Rae would lead to worse sanitary conditions and more serious health problems in the community. Accordingly, a decision was made to locate a new territorial school at Edzo and encourage relocation of the Dogrib Indians from Rae.

The roads in Edzo were built in 1969. Construction of water and sewer systems began the following year. Less than 300 people moved into the new community. With little incentive to leave Rae, the parent community continues to grow.

A.3 Community Information

The permanent population of Edzo is 200 - 250. The school has about 400 students, many of whom are bused from Rae every day.

A 12 bed hospital provides medical services to the twin communities.

The school, the hospital and the Department of Public Works maintenance shop and garage are the most visible sources of employment.

A.4 Geology and Terrain

The site consists of sandy sloping ground bounded by the highway on the south and by muskeg to the north and west.

The first 1.2 to 1.5 m of soil consists of granular material, sands and gravel. This layer is underlain by shale bedrock. Between the ridges of deposited material are areas of muskeg underlain by impervious clay.

Edzo is located in the discontinuous permafrost zone.

A.5 Vegetation

The land skirting the settlement is heavily forested with spruce, poplar, jack pine, willow and other hardy species. Mosses, low bushes and grasses cover open areas.

A.6 Climate

The seven month winters last from October to April

with a mean daily temperature of -30°C in January. The summers from June to August are cool, with a mean daily temperature of 16°C in July. The mean frostfree period is 113 days. Ice forms on the lakes in October and leaves in early June.

The average annual precipitation is abut 250 mm of which 60% falls as rain. Prevailing winds are from the north and east.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Water is pumped through an intake in West Channel to a distribution pumphouse where it is filtered and chlorinated and stored prior to distribution. All lots have connections to the watermain.

Following are some chemical analysis results from samples collected by GNWT in 1980 showing ranges of values for certain constituents: (All values in mg/L unless otherwise noted)

Parameter	**Value**
Sodium (Na)	5.0
Potassium (K)	1.0 - 2.0
Calcium (Ca)	39.1 - 41.2
Magnesium (Mg)	12.6 - 16.9
Hardness (as $CaCO_3$)	154.8 - 167.2
Chloride (Cl)	7.0 - 10.7
Alkalinity (as $CaCO_3$)	84.1 - 86.0

B.1.2 Intake Facilities

A 24 m, 150 mm Schedule 40 steel intake pipe extends 15 m into West Channel 152 m south of the Mackenzie Highway crossing and 305 m from Great Slave Lake. The coal tar epoxy-coated pipe is supported on a double row of steel pipes 1.5 m below the water level. It is heat traced for 15 m from the pumphouse.

The intake is a half section of 250 mm pipe, the openings of which are covered with 6.4 mm (1/4") screen. Water discharges through the intake and pipe to two wet wells 2.7 m deep. Two turbine pumps alternately pump water through 753 m of 100 mm Series 100 HDPE pipe to the distribution pumphouse. There is a 75 mm (3") Series 100 HDPE return line parallel to the supply pipe. They are both covered with 50 mm of polyurethane rigid foam under a 45 mil high density polyethylene coating.

B.1.3 Treatment

The treatment building is located at the lower end of Town. There the water is treated by a WB-82 package Waterboy treatment plant.

B.1.4 Storage

Treated water is stored in an earth covered concrete reservoir beside the pumphouse. It has a capacity of 909 200 L (200 000 igal).

B.1.5 Pumping Facilities

Intake Pumphouse

1. Function: Supply pumps (2) from intake to distribution pumphouse
Type: vertical turbine
Capacity: 189 L/min @ 358 kPa (50 USgpm @ 120') TDH
Motor: 3-phase, 208V, 750 RPM electric

Distribution Pumphouse

1. Function: Distribution pumps (2)
Type: vertical turbine
Capacity: 191 L/min @ 358 kPa (42 Igpm @ 120') TDH

2. Function: Standby distribution pump
Type: vertical turbine
Capacity: 377 L/min @ 358 kPa (83 Igpm @ 120') TDH

3. Function: Fire pump
Type: vertical turbine, diesel engine driven
Capacity: 63 L/s @ 492.5 kPa (833 Igpm @ 165') TDH

B.2 Water Distribution

The watermains in the looped single main system are 150 mm and 200 mm asbestos-cement shallow-buried pipes. They were factory insulated with 50 mm of polyurethane foam covered with a polyethylene yellow jacket.

Water is heated at the pumphouse prior to distribution and heat tracing is not provided.

The water pipe in the service connections is 20 mm Type K soft copper tubing, insulated with 50 mm of preformed polyurethane insulation.

As of 1977, 20 of the service connections were heat-traced. In 40 other homes there was a dual service connection with a small pump in the residences, drawing water from one and discharging to the other to prevent freezing.

B.3 Sewage Collection

The sewer mains are 150 mm and 200 mm asbestos-cement shallow-buried pipe. They were factory insulated with 25 mm of urethane and covered with a yellow jacket.

The service connections are 100 mm asbestos cement pipe also insulated with 25 mm of urethane and covered with a yellow jacket.

Sewage flows by gravity to a lift station which discharges through a forcemain to the lagoon system.

The lift station is located at the east end of the community as shown on the aerial photo. It contains two pumps, each capable of handling peak sewage flows. The pumps discharge into a 150 mm diameter buried forcemain to a high point in the line where the sewage then flows by gravity along a 200 mm diameter line to the sewage lagoon system. The forcemain runs about 640 m west beside the highway, thence, 460 m south to the lagoons as shown in the photo.

B.4 Sewage Treatment

The lagoon system is located south of the community and consists of two primary cells, each having dimensions of roughly 37 m x 37 m at the water line and a depth of 4.3 m. The inside side slopes are 3:1. The total lagoon capacity is about 4,860 m^3 which provides a total possible theoretical retention time of 51 days at an average daily sewage flow contribution of 95,470 litres per day. It is estimated that the average sewage flow for Edzo is approximately 318 lpcd (70 igpcd). The primary treated effluent discharges into a small ditch where it travels about 400 m prior to entering Great Slave Lake.

B.5 Solid Waste Collection and Disposal

Garbage collection is handled by local contract and is disposed at a location south of the community immediately west of the sewage lagoons. The garbage is collected three times per week. The Hamlet maintains the dump site using landfill methods.

B.6 Roads and Drainage

All roads in Edzo are gravel surface, and are in good condition. There are no curbs, sidewalks or ditches.

Drainage is good due to the sloping ground and the porous soil.

B.7 Fire Protection

A firetruck is stored in a small firehall. Further protection is afforded by hydrants along the watermain.

The Edzo firetruck is a 1970 triple combination pumper. About 9 call boxes are connected to an annunciator panel. Twelve volunteers are on call.

B.8 Other Services

CBC radio and television are available. Mail is picked up at the settlement office in Rae. NCPC provides power which is generated from the Snare River Hydro Development.

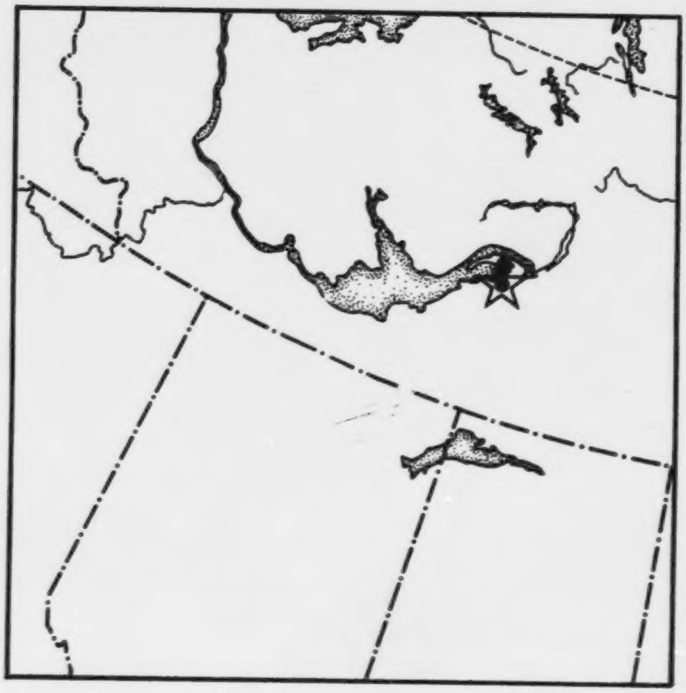
INFORMATION SOURCES

1. Associated Engineering Services Ltd., *Investigation for School Site and Community Site, Rae, N.W.T.,* September, 1965.

2. Department of Public Works, G.N.W.T., *Specifications for the Construction of a Water Supply and Related Services at Edzo, N.W.T.,* 1973.

3. Jack Grainge Regional Engineer, N.W.T. Region, Department of National Health and Welfare, *Environmental Conditions and the Proposed Development of Rae-Edzo, N.W.T.,* March, 1977.

Snowdrift



TO GARBAGE & BAGGED
SEWAGE DUMP & AIRPORT

SNOWDRIFT

SCALE - 1: 7,500
N.A.P.L.
NO. A25249-132 17/7/79

Aerial view

A. GENERAL

Snowdrift is situated at the end of a peninsula that juts into Christie Bay on Great Slave Lake. It is 201 km east of Yellowknife by air. The co-ordinates are 62°23'N latitude and 110°47'W longitude.

In 1925, the Hudson's Bay Company established a trading post on the peninsula; however, the Chipewyan natives occupied a site 3.2 km away until they and other natives in the vicinity founded the community of Snowdrift in 1954-56.

The settlement of Snowdrift had 285 permanent residents in 1980; a slight increase of 23 persons over the past 3 years. Although the majority earn their living by trapping, a few work in the Co-Op store, primary school, hotel or nursing station. Some employment is generated in the summer by local fishing lodges and commercial fishing.

The 583 m x 24 m rough gravel airstrip is located adjacent to the Snowdrift River at 175.3 m A.S.L., 2 km from the community. There are regular flights into the community from Yellowknife. An N.T.C.L. barge visits the settlement in the summer.

Snowdrift is underlain by precambrian sedimentary and volcanic rock. A thin layer of soil covers the surface. There is much exposed rock in the region. The terrain is rolling and features hills and ridges, but the Townsite itself occupies fairly low flat land. Permafrost poses no construction problems due to the bedrock.

Snowdrift is about 160 km west of the treeline and, consequently, has vegetation characteristic of the subarctic. Black and white spruce, poplar, tamarac, willow and birch grow in the vicinity. Mosses, grasses and low brush cover open land.

The average amount of rainfall in a year totals 166 mm. Another 1267 mm falls as snow. Summer lasts from the end of June to August, the mean high temperature is 21°C in July and the mean low temperature is 12°C.

Winters are cold and long. The lake freezes in October and the ice breaks up in June. The mean low temprature is -30°C and the mean high temperature is -22°C in January.

B. MUNICIPAL SERVICES

B.1 Water Supply

Water is currently taken from a hole in the Great Slave Lake ice on the north side of the community in winter and generally from the Snowdrift River 3 km away in summer. The lake water is silty if there is a strong west wind in the summer. Water is trucked to the community.

Mineralization in the lake is low because drainage is over the aforementioned precambrian rock. The chemical quality of the Great Slave Lake water is good as shown by this analysis of a sample taken 30 m from shore on October 10, 1979. (NOTE: All values in mg/L unless otherwise indicated)

CONSTITUENTS	
Ca (mg $CaCO_3$)	56.7
Mg (mg $CaCO_3$)	21.0
Total Hardness (mg $CaCO_3$)	77.7
Total alkalinity (mg $CaCO_3$)	67.0
Total dissolved solids	136.9
pH	7.5
Turbidity	1.2
Colour	6 Units
Suspended solids	3
Iron (Fe)[average of 4 samples]	0.81

B.1.3 Intake Facilities

There are presently no intake facilities, however, consideration is being given to construction of an insulated intake pipe into the lake, and a pumped water supply to a truck fill point.

The water is not chlorinated regularly at present.

B.2 Water Distribution

Water is delivered twice a week in a 3400 L water truck. The consumption is 23 000 L/week or about 12 L/cd. The Council pays for water delivery and the consumer receives water free of charge.

B.3 Sewage Collection and Disposal

The native residents utilize bagged sewage or privies. The homes of government employees have leach pits generally consisting of buried wood cribs. Six buildings have pumpout tanks at the present time.

Bagged sewage is collected from the majority of homes three times per week in an open two-ton truck. The bagged sewage disposal pit is beside the solid waste disposal site. Pumpout sewage is also disposed of with the bagged sewage.

B.4 Solid Waste Collection and Disposal

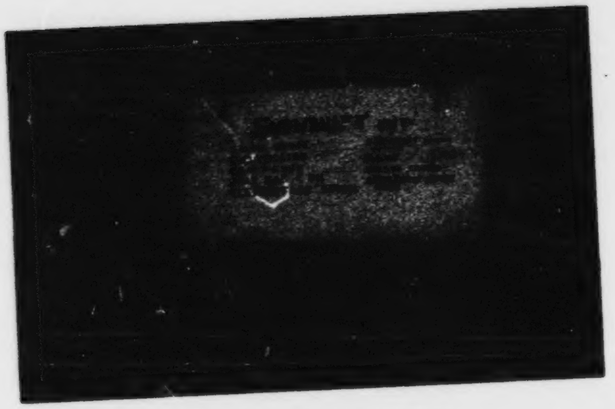
Garbage is placed in 205 L (45 Igal) drums on elevated wooden stands in front of each residence. Twice a week a two-ton truck collects the waste and transports it to a site 2 km west of the settlement near the airstrip. Occasionally, the garbage is burned and buried.

B.5 Roads and Surface Drainage

Roads are gravel surfaced in Snowdrift. Drainage within the settlement is good. The ground dries quickly after the infrequent precipitation.

B.6 Fire Protection

Snowdrift has no fire truck or volunteer organization. Equipment consists of extinguishers in homes.



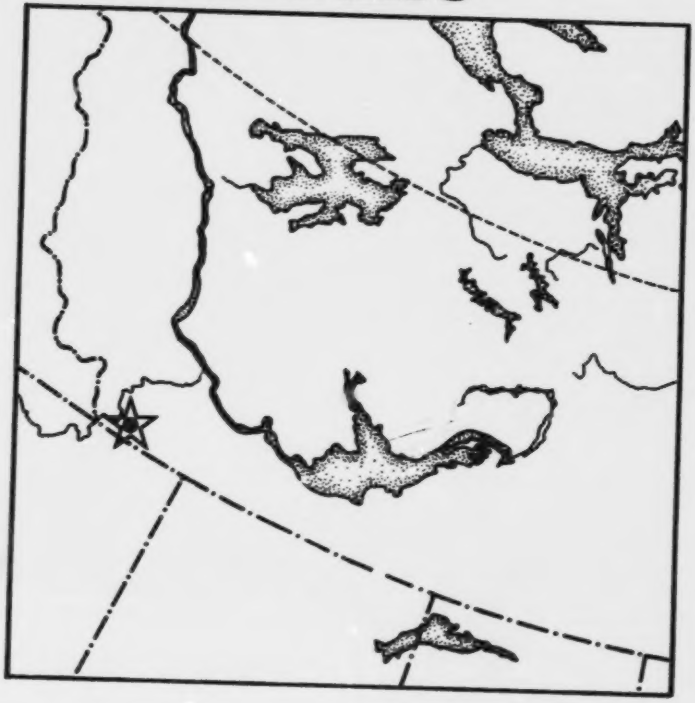
INFORMATION SOURCES

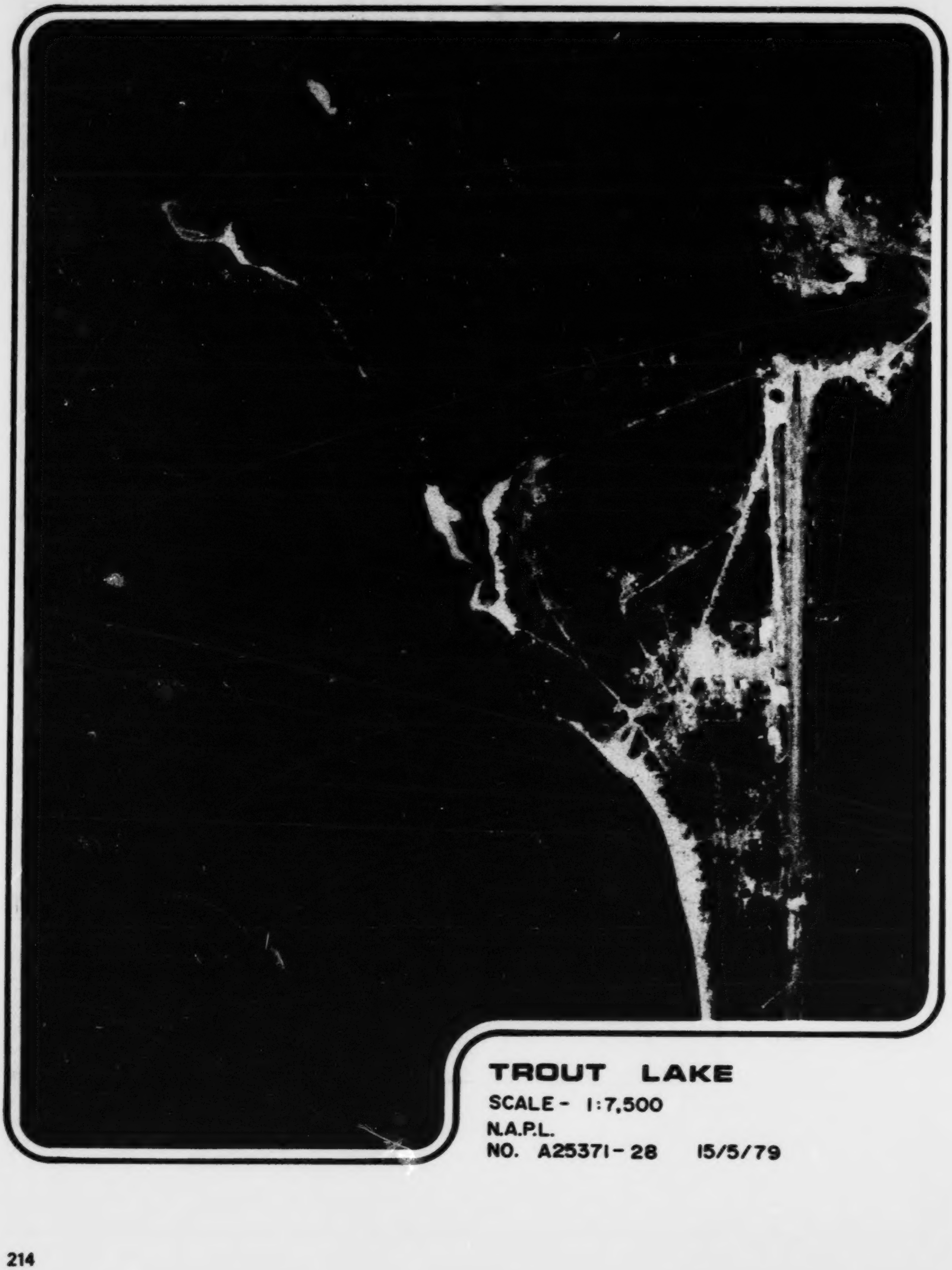
1. R.T. Gajda, Department of Mines and Technical Surveys, Geographical Branch, *Snowdrift Settlement, N.W.T., Terrain and Site Analysis*, Ottawa, 1963.

2. Ferguson, Naylor, Simek Limited, Consulting Engineers & Planners, *Predesign Report for Engineering Services - Snowdrift, N.W.T.*, Yellowknife, June, 1980.

3. Neil Bryant, Area Head, Water Resources, DIAND, *Overview of Snowdrift Water Utilities*, July, 1980.

Trout Lake





TROUT LAKE

SCALE - 1:7,500
N.A.P.L.
NO. A25371 - 28 15/5/79

Log houses in community

A. GENERAL

This unorganized community is situated on the shore of Trout Lake, 161 km south of Fort Simpson by air and 442 air km southwest of Yellowknife. The geographical co-ordinates are 60°26′N latitude and 121°15′S longitude.

The residents are Slavey people. The population numbered 63 in 1980 and has been stable for the past 3 years.

The economy is based on hunting, trapping and fishing. A fishing lodge that is open during the summer months has generated additional income. Some men are employed seasonally on government projects.

Float planes land on the lake in the summer. Aircraft utilize an ice strip in winter.

The land upon which the buildings rest is flat and sandy and the area is thickly wooded.

The July mean high and low temperatures are 26°C and 12°C respectively and the mean low temperature is -33°C. The average annual rainfall totals 381 mm. Snowfall amounts to an average of 1320 mm.

B. MUNICIPAL SERVICES

B.1 Water Supply

All water is hauled individually in buckets from the lake. The water is not treated.

B.2 Sewage Collection

The entire population utilizes outdoor pit privies.

B.3 Solid Waste

Garbage is burnt by the individual residents. There is no organized pick-up service.

B.4 Roads and Surface Drainage

There are no roads in the community only paths and trails.

B.5 Fire Protection

The only equipment consists of fire extinguishers in homes.

B.6 Other Services

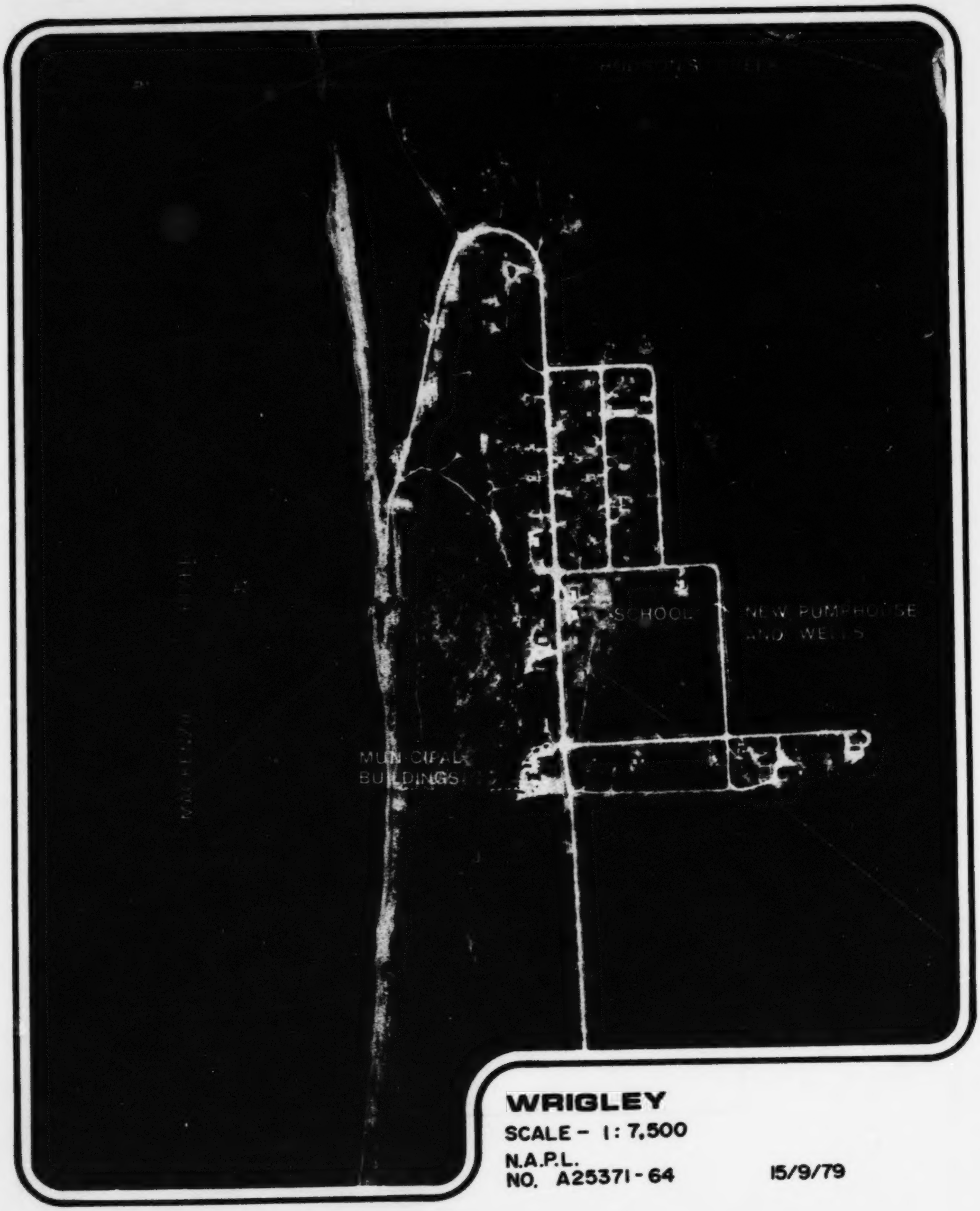
The community has an General Store, a community centre, a primary school, radio, telephone service, and a Roman Catholic Church. There is no electricity.

INFORMATION SOURCES

Ev Kinsman, Area Maintenance, Hay River, Former AMO, Fort Simpson, Communication of October, 1980.

Aerial view

Wrigley


SCHOOL
NEW PUMPHOUSE AND WELLS
MUNICIPAL BUILDINGS
MACKENZIE RIVER

WRIGLEY

SCALE - 1: 7,500

N.A.P.L.
NO. A25371-64 15/9/79

A. GENERAL

A.1 Location

Wrigley is located on the east bank of the Mackenzie River at 63°16'N latitude and 123°37'W longitude. The native community is 193 km by air north of Fort Simpson and 466 km by air northwest of Yellowknife. The Franklin and Mackenzie mountain ranges frame the Mackenzie River. Small hot springs along the riverbanks are found in the vicinity.

A.2 History

Slavey Indians settled at Old Fort Island in 1821, 39 km from the present site. In 1905 the Indians abandoned the site due to famine and tuberculosis and re-settled 48 km downriver on the west bank. The Fort Wrigley population grew to 128 by 1960. By that time the settlement had a school. However, the area was poorly drained so the community was relocated to a site 11 km upstream on the east bank of the Mackenzie in 1965. An airstrip had been built at Fort Wrigley's present location by the American Army in 1944.

A.3 Community Information

The predominately native population numbered 162 in 1980. The number of persons has decreased somewhat from the 1978 and 1977 population figures of 163 and 175 respectively. The settlement does not expect much growth unless pipeline construction in the Mackenzie Valley materializes. The economy is based on hunting, trapping and some work with the Co-Op. A sawmill was built at the north end of the Townsite.

Facilities include a primary school, a skating rink, a swimming pool, a nursing station and a Roman Catholic Church as well as the Hudson's Bay store.

The airstrip is a cleared rough surface 61 m by 1287 m.

A.4 Geology and Terrain

Both the Townsite and airstrip are on a high fluvial terrace 4.8 km long x 0.8 km wide. Bedrock in the Mackenzie Plain is covered with thick layers of unconsolidated material. The bedrock is shale, silt stone and sandstone under well graded gravel and some sand. The sites organic cover has a thickness of 0.3 to 0.5 m.

The settlement is in the discontinuous permafrost zone. The active layer is 0.6 m to 2.1 m thick. Permafrost extends to a depth of 24 to 27 m.

A.5 Vegetation

An organic soil layer 0.3 to 1.2 m thick is generally topped with bushes and mosses. The terrain surrounding Wrigley is forested with poplar, white and black spruce, tamarack, willow and birch. Permafrost muskeg in poorly drained areas is treeless; mosses, peat and lichens predominate.

A.6 Climate

The mean daily temperature in July is 16°C. The corresponding temperature in January is -30°C. There is an average of 130 frost free days. The average annual snowfall amounts to 1285 mm and the average rainfall is 195 mm.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Before new water supply facilities went into operation in 1975 the community obtained water from various sources. Hodson's Creek water was used in winter. Pumps were set on the ice at the creek's mouth near the bank of the Mackenzie. When the ice went out the water at that point became highly turbid. Hence a well was used intermittently since 1966 as a summer water source. It was abandoned in 1973.

A spring near airport Road became the primary source, though inadequate as a summer supply. It provided 36 L/min and a 22 730 L (5000 Igal) storage tank was installed beside it when the well failed.

Eventually two new wells were drilled, and a new pumphouse was built in 1975, housing a new storage tank beside the relocated old one. The wells produce a year-round water supply adequate for a population of 500 persons on a trucked distribution system.

B.1.2 Intake Facilities

The production well is 43.3 m deep and cased to 43 m. The standby well is 44.5 m deep and cased to 42.7 m. A 50 mm (2") heat-traced pipe carries the water to the pumphouse.

The long term well yield is conservatively estimated at 23 L/min (5 Igpm), with a possible projected yield of 225 L/min (50 gpm).

The 100 mm (4") submersible well pump has the following characteristics:

Model:	Jacuzzi Model 15S-4B-26
Capacity:	62 L/min (820 gal/hr) @ 137.9 kPa (20 psi)
Motor:	1-1/2 HP, 3-phase, 208V, 60 cycle

B.1.3 Treatment

Wallace and Tiernan Series A-588 is used for chlorination. A spare chemical feed pump - Precision Chemical Feed Pump Series 8000, Model 8301-11 is provided.

B.1.4 Storage

The 8.5 m x 10.4 m log building beside the wells hold one 22 730 L (5000 Igal) and one 15 910 L (3500 Igal) steel tanks. The new tank is lined with cement mortar.

B.1.5 Pumping Facilities

The pumphouse contains two distribution pumps.

Model:	Armstrong Series 4030, size 2-1/2D
Capacity:	682 L/min @ 60 kPa (150 Igpm @ 20') TDH
Motor:	1-1/2 HP, 3-phase, 208V, 60 cycle

The two transfer pumps for pumping water into the tank have the following characteristics:

Model:	Clarke Storke NU Series 17.8
Capacity:	568 L/min @ 59.7 kPa (125 Igpm @ 20') TDH
Motor:	1-1/2 HP, 3-phase, 208V, 60 cycle, 1750 RPM

B.2 Water Distribution

All water is delivered in a truck with a tank capacity of 5000 L (1100 Igal).

B.3 Sewage Collection and Disposal

The community is served primarily by pit privies. Honeybags are collected and deposited in an open cesspit under local contract. Some institutional buildings have individual leach pits.

B.4 Solid Waste

Garbage is deposited in a dump approximately 2 km west of the community where it is burned. Petanea Co-Op Association Limited had the contract to service 174 persons.

B.5 Roads and Surface Drainage

Roads are gravel surfaced in the community. Drainage problems are minimal due to the pervious nature of the soils.

B.6 Fire Protection

There are 5 call boxes connected to a siren. The water truck is the only means of fighting fires. The amount of water in the storage tanks reserved for fire fighting is a minimum 50% of capacity.

B.7 Other Services

Mail is distributed from the Hudson's Bay Store twice a month. Access to the settlement is by air, by the N.T.C.L. barge service from Hay River, or via a winter road from Fort Simpson.

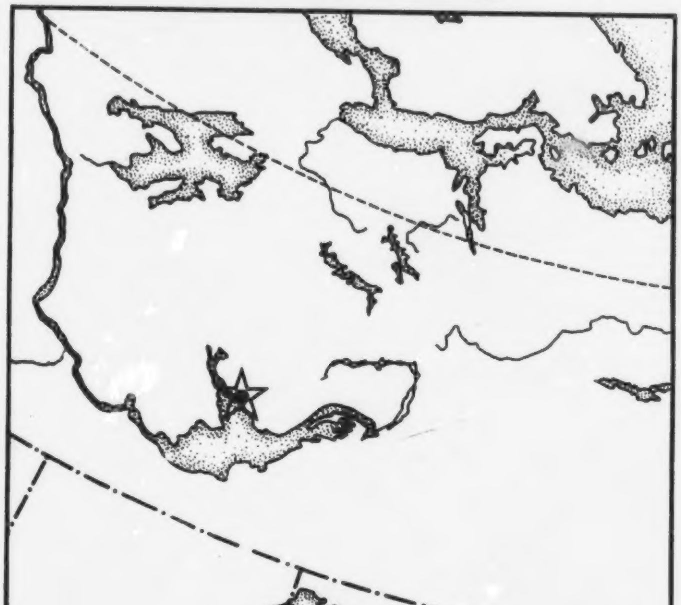
INFORMATION SOURCES

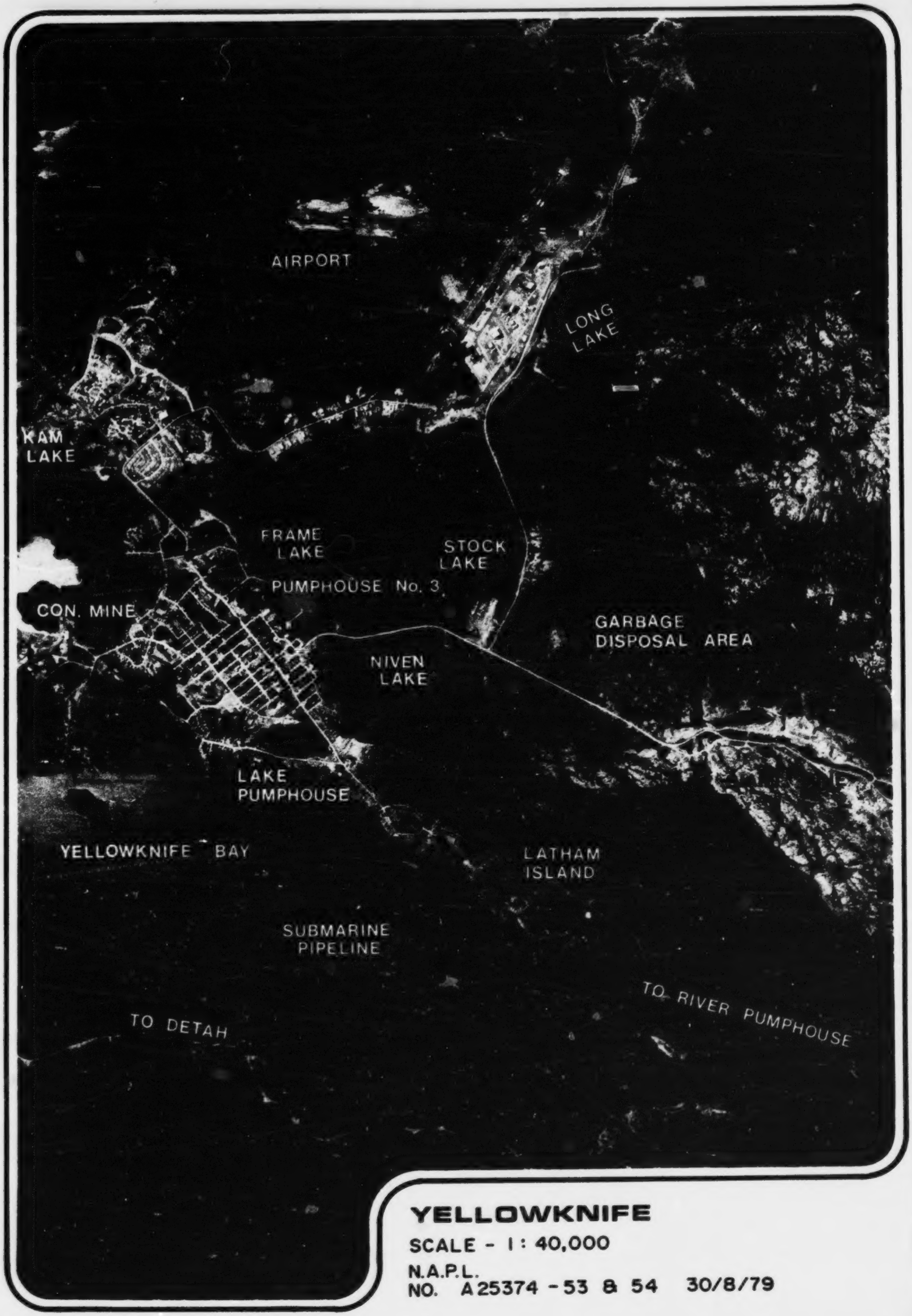
1. Department of Indian Affairs and Northern Development, *Granular Materials Inventory, Wrigley, N.W.T.*, 1972.

2. Government of the N.W.T., Department of Public Works, *Specifications for the Construction of the Water Supply Pumphouse at Wrigley, N.W.T.*, Project No. 72-597.

3. Government of the N.W.T., *Operations and Maintenance Manual for Water Supply System, Wrigley, N.W.T.*, 1975.

Yellowknife




AIRPORT
LONG LAKE
KAM LAKE
FRAME LAKE
STOCK LAKE
PUMPHOUSE No. 3
CON. MINE
GARBAGE DISPOSAL AREA
NIVEN LAKE
LAKE PUMPHOUSE
YELLOWKNIFE BAY
LATHAM ISLAND
SUBMARINE PIPELINE
TO DETAH
TO RIVER PUMPHOUSE

YELLOWKNIFE

SCALE - 1 : 40,000

N.A.P.L.
NO. A25374 - 53 & 54 30/8/79

Aerial view

A. GENERAL

A.1 Location

Yellowknife is located on the west shore of Yellowknife Bay, on the north arm of Great Slave Lake. It has co-ordinates of 62°28'N and 114°26'W and is about 960 km north of Edmonton by air. It is 1,524 km by road to Edmonton.

A.2 History

The name Yellowknife first appeared in Samuel Hearne's Journal of his travels to the Arctic Coast for the Hudson's Bay Company in 1771. The tribe of Indians inhabiting the area around Great Slave Lake were called Yellowknife Indians because he found them using utensils made of pure copper.

As a result of Sir Alexander Mackenzie's visit in 1789, a trading post known as Fort Providence was established near the mouth of Yellowknife Bay. This post was in existence when Sir John Franklin made his journey to the Coppermine River in 1820 but was abandoned shortly afterwards.

In 1934, visible gold was found on the shores of Yellowknife Bay. In 1936 and 1937, the Consolidated Mining and Smelting Company of Canada sank shafts and commercial gold production began. By 1940, Yellowknife was a 'boom-town' of about 1,000 people. Over the next few years, the population increased to about 3,000 on the peninsula which is called Old Town. In 1945 a new site was surveyed and occupied on the site where most of the City now exists. Also in 1945 a new rush started when Giant Yellowknife Mine opened. By the end of 1947, two mines were in large scale production. In the summer of 1953, Yellowknife became a Municipal District and the first mayor was elected. In 1967 Yellowknife was named capital of the Northwest Territories and on January 1, 1970 became the first City in the Territories. Yellowknife began as a gold mining town, and gold mining continues to be the major industry in the City at present.

A.3 Community Information

The population of Yellowknife has shown a drop of 3.7% between 1980/79 as shown by the following figures:

YEAR	POPULATION
1978	9,981
1979	9,918
1980	9,550

The population is about 10% native at present.

As the largest community in the Northwest Territories, Yellowknife has numerous schools, service clubs, organizations, churches and associations. It is the Territorial Government administrative capital of the N.W.T. as well as the base for many federal government departments and private companies operating in the Territories.

Yellowknife has a controlled airport with two paved strips, one being 2,286 m x 46 m and the other 1,524 m x 46 m. Numerous aircraft companies operate scheduled and charter air services from the airport and float bases located on Latham Island. Pacific Western Airlines provides regular air service from Edmonton, Winnipeg and Whitehorse to Yellowknife and other centres in the N.W.T.

A.4 Geology and Terrain

Yellowknife is located in an area that is typical of the Precambrian Shield. Four main rock types can be seen in the area namely, granites, volcanics, sediments, and late intrusions.

The topography is generally flat with many outcrops and small rocky hills in the area. The region is dotted with numerous lakes and much is covered with muskeg.

Permafrost is sporadic in the area and during the summer can be encountered 0.5 m below moss or muskeg, 3 m or more below the surface of sandy soils or non-existent in other areas.

A.5 Vegetation

Trees in the area are predominantly black and white spruce and pine with birch and poplar stands found in valleys and on occasional sand plains.

A.6 Climate

Yellowknife experiences mean high and low July temperatures of 20.4 and 11.3°C respectively. The January mean highs and lows are -23.4 and -32°C. The total yearly precipitation is about 254 mm and the prevailing winds are easterly at 8.9 knots.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Prior to 1969, the City of Yellowknife as well as Giant and Con Mines, obtained water directly from three separate intakes in Yellowknife Bay. Tailings entering the bay from mining operations were high in arsenic which made it necessary to obtain potable water from a point at the mouth of the Yellowknife River before it enters the bay.

In 1969 a new water intake was constructed on the Yellowknife River near its mouth and a 400 mm diameter submarine pipeline on the bottom of the Bay delivered water to serve the City and both mines. The Lake pumphouse was also upgraded to meet the City's increasing water demand and in 1971 a 2,273 m^3 (0.5 Million Igal) reservoir was added to the system to meet demands in the westerly section of the City.

The water distribution is underground and for the most part can be considered conventional with systems similar to those in southern Canada except that recirculation and heating is provided for winter freeze protection.

B.1.2 Water Source

Yellowknife River water is of good chemical quality for use as a potable water source as shown by the values in the following chemical analysis obtained by DIAND Water Resources in 1979 and 1980. (All values in mg/L unless otherwise noted)

Parameter	**Value**	
	Dec. 13	**June 26**
ph	7.2	7.7
Colour	5	5 Units
Calcium (Ca)	4.4	4.8
Hardness (as CaCO$_3$)	15.3	14.1
Alkalinity (as CaCO$_3$)	13	8
Sodium (Na)	1.5	1.5
Potassium (k)	0.5	1.05
Chloride (Cl)	19.5	6.7
Sulphate (SO$_4$)	12.7	1
Nitrate (NO$_3$)	0.1	0.33
Phosphorous (P)	0.01	0.02
Arsenic (As)	0.005	0.005
Iron (Fe)	0.09	-
Lead (Pb)	0.05	-
Nickel (Ni)	0.05	-
Zinc (Zn)	0.02	-

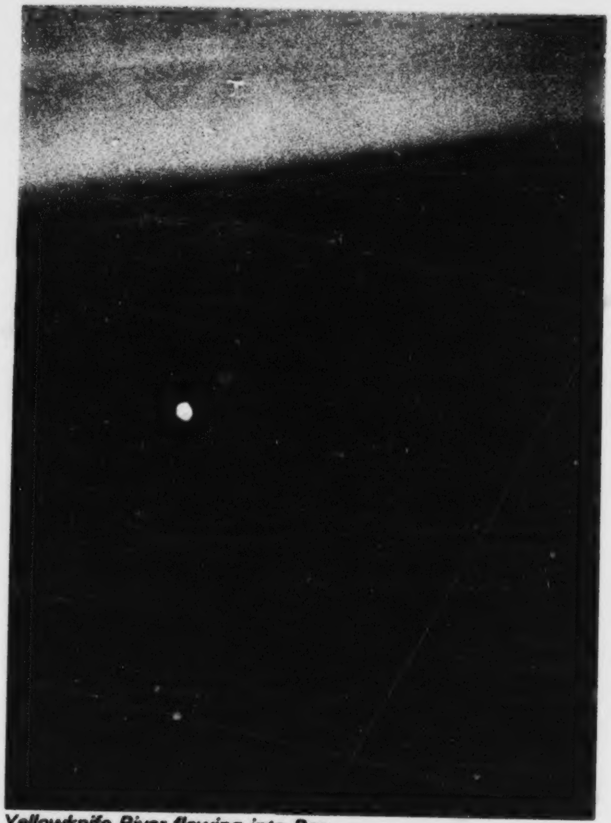
B.1.3 Intake Facilities (Pumphouse No. 2)

The pumphouse at the river intake consists of the following pumping system:

1. Supply Pump (1)

Type:	Vertical Turbine
Capacity:	114 L/s @ 909 kPa (1500 igpm @ 300 ft. TDH)
Drive:	200 HP variable speed

Yellowknife River water intake (upstream of bridge)



Yellowknife River flowing into Bay

2. Supply Pump (1)
   Type: Vertical Turbine
   Capacity: 114 L/s @ 909 kPa (1500 igpm @ 300 ft. TDH)
   Drive: 200 HP constant speed
3. Standby Pump (1)
   Type: Vertical Turbine
   Capacity: 194 L/s @ 273 kPa (1283 igpm @ 90 ft. TDH)
   Drive: diesel engine

B.1.4 Submarine Supply Line

The 400 mm supply line from the intake pumphouse (Pumphouse No. 2) is 400 mm in diameter steel pipe with welded joints. It runs along the bottom of the bay to the Lake pumphouse as shown on the aerial photo. Both mines are served by the River Pumphouse through two branches from the main line. The branch line serving Giant Mine is 200 mm in diameter and the one serving Con Mine is 150 mm in diameter. In 1979 their combined consumption was 18.5% of the total water supplied from the River Pumphouse.

B.1.5 Lake Pumphouse (Pumphouse No. 1)

The lake pumphouse supplies water directly to the distribution system serving the whole City except for areas in the south end which are served by Pumphouse No. 3. The system at the Lake Pumphouse consists of the following:

1. Supply Pumps (2) (Added in 1979)
   Capacity: 63 L/s @ 630 kPa (833 igpm @ 208 ft. TDH)
   Drive: 75 HP electric
2. Supply Pumps (3)
   Type: Split case horizontal
   Capacity: 41 L/s @ 758 kPa (542 igpm @ 250 ft. TDH)
   Drive: electric motor
3. Circulation Pumps (2)
   Type: Split case horizontal
   Capacity: 23 L/s @ 185 kPa (300 igpm @ 61 ft. TDH)
   Drive: electric motor

A generator set of 150 KWA capacity supplies power to two supply pumps and the boiler or the three supply pumps during power failures.

For fire protection, the supply is drawn directly from the lake. The present fire pump is diesel driven with a capacity of 63 L/s @ 909 kPa (833 Igpm @ 300 ft. TDH). In 1982 new 600 mm (24 inch) diameter intake will be on-stream and the existing fire pump will be replaced with 2 new diesel driven, vertical turbine fire pumps each having a capacity of 19 L/s @ 876 kPa (250 Igpm @ 289 ft. TDH).

Prior to leaving the station, the water is heated to about 8°C during winter, by three boilers with a total capacity of 7,920 BTU/hr. The return flow from the water distribution system passes though the circulation pumps prior to re-entering the system. The water is also chlorinated at this point.

B.1.6 Pumphouse No. 3

Pumphouse No. 3 was designed to serve the southern end of the City including the areas known as Mattonabee, Forrest Park Stage 2, Northland Trailer Park as well as the Hospital and Correction Centre. The pump system consists of the following:

1. Supply Pumps (3)
   Type: Split case horizontal (electric motor driven)
   Capacity: 11.8 L/s @ 30.5 m TDH (142 igpm @ 10 ft. TDH)

Return flows from Mattonabee and the Correctional Centre are circulated through two circulating pumps prior to re-entering the line.

A diesel driven standby pump with a capacity of 63 L/s @ 70 m TDH (833 igpm @ 230 ft. TDH) is used for fire protection and also during power failures.

B.1.7 Pumphouse No. 4

Pumphouse No. 4 is located at the south end of the City beside the newly constructed 5,683 m³ reservoir. This station was sized to meet the ultimate design demand of the Frame Lake South Subdivision with a future population of 10,000 persons. It contains the following pumping equipment:

1. **Supply Pump (1)**
   Type: Vertical Turbine
   Capacity: 22 L/s @ 527 kPa (292 Igpm @ 174 ft. TDH)
   Drive: 25 HP electric
2. **Supply Pump (1)**
   Type: Vertical Turbine (variable speed)
   Capacity: 40.4 L/s @ 606 kPa (633 Igpm @ 200 ft. TDH)
   Drive: 50 HP electric
3. **Supply Pump (1)**
   Type: Vertical Turbine
   Capacity: 56.8 L/s @ 682 kPa (750 Igpm @ 225 ft. TDH)
   Drive: 75 HP electric

A 5 HP pump is used for recirculation of water in the system. The station is designed with provision for three more pumping systems to be installed as the demand increases.

It also provides heating of the water through the use of boilers.

B.2 Water Distribution

B.2.1 Piped System

Water distribution in the central business district and surrounding residential area consists mainly of 150 mm diameter ductile iron supply lines and 100 mm diameter single return lines. The lines are connected at the ends of blocks by 0.79 to 3.2 mm diameter orifices. The system includes two underground reservoirs. One is located at Pumphouse No. 3 and is 2,273 m^3 (500,000 Igal) in capacity. The other reservoir completed in 1980, is 5,683 m^3 (1,250,000 Igal) in size and is located in the relatively new Frame Lake Subdivision at the southern end of the City. These reservoirs provide equalization and fire protection storage.

A number of freeze protection methods for services have been tried over the past years. Ones that are still in use include Impedance heat tracing and other heat tracing types such as Pyrotenax, Thermon (13 watts/m) and Chemelex (26 watts/m). Pitorifices are used in some sections of the City when a single main circulation system is used. Almost all services are insulated. Approximately 98% of all water consumed in the City is metered.

Some bleeding still exists in certain sections of the City to prevent freezing during the winter.

B.2.2 Truck Delivery

About 140 residents are served by truck delivery. These are mostly located in the area of the City known as Old Town, including Latham Island. This area is very rocky and not considered to be cost efficient to be served by a conventional piped distribution system. During the summer months, much of the area is serviced by small diameter surface lines however. This truck delivery service is locally contracted.

Summer water lines in "Old Town"

B.2.3 Water Consumption

Following is a summary of the total water consumption within the City of Yellowknife for the year 1979.

	Million Litres	Million Imp.Gallons
1. Cominco Mines	146.8	32.3
2. Giant Mines	132.7	29.2
3. City of Yellowknife		
Metered	772.4	196.9
Un-Metered	15.9	3.5
Delivered	25.9	5.7
Surface Water Lines	25.0	5.5
Bleeders	181.8	40.0
Seepage, Water Breaks, Fires	90.9	20.0
	1,234.7	271.6
4. Total Water Pumped from River Pumphouse	1,513.8	333.0

B.3 Sewerage System

B.3.1 General

Sewage treatment for the City of Yellowknife began in 1948 with construction of a primary mechanical treatment plant which permitted settling and digestion of solids. This was located at the south end of the old townsite and it discharged into Niven Lake. This small, shallow lake (about 7.9 ha) overflowed into Yellowknife Bay. In 1962, use of the plant was discontinued and Niven Lake was used as a faculative lagoon. In 1964 a primary short detention pond was added to the Lake to help overcome treatment inadequacy. At that time the level of treatment was relatively good with a calculated 99 day retention time and BOD_5 removal rates of about 77% being observed during the summer.

As the population increased, the removal efficiency of Niven Lake reduced drastically and alternate methods were explored. For the past half dozen years the majority of Yellowknife's sewage has been discharged to Kam Lake which overflows to a drainage system and ultimately to Great Slave Lake. Due to City expansion to the area of Kam Lake and the desire to preserve the water quality in the lake for possible future use, it was decided to pump all of the City's sewage into a drainage area west of Yellowknife. This drainage system consists of a series of small lakes and drainage channels which eventually discharges to Great Slave Lake.

B.3.2 Sewage Collection

B.3.2.1 Piped System

Most of Yellowknife's original collection system consists of corrugated metal sewers, largely 200 mm in diameter. Asbestos cement and ductile iron sewer pipes are also used in the City. Manholes are mostly of concrete block construction and are provided with 'frost covers' to help prevent heat loss from the system and thus prevent freezing.

The system is made up of several gravity subsystems and four lift stations (i.e. School Draw Lift Station, Forrest Park Lift Station, Frame Lake South Lift Statin), and Mattonabee Lift Station. Construction will be completed in 1981 in Lift Station No. 5 located at the north end of Kam Lake. This station will be a split wet well type containing the following pumping system:

1. Main Pumps (2)

   Capacity: 158 L/s @ 485 kPa (2083 Igpm @ 160 ft. TDH)

   Drive: Electric (one 150 HP constant speed and the other 200 HP variable speed)

2. Standby Pump (1)

   Capacity: 253 L/s @ 394 kPa (3333 Igpm @ 130 ft. TDH)

   Drive: Diesel (200 HP)

An emergency overflow is provided at the station which will discharge to Kam Lake in station failure situations. This station is sized to handle all of Yellowknife's sewage and has a design peak capacity of 316 L/s (4167 Igpm). It will pump via forcemain to the Fiddler's Drainage Area for treatment.

This station will collect all of Yellowknife's sewage and discharge it through 8 km of HDPE, insulated forcemain (550 to 450 mm diameter) to the Fiddler's Drainage area west of the City.

B.3.2.2 Trucked System

About 140 residences mostly in Old Town are equipped with holding tanks and are on regular sewage pick-up service. The service is presently contracted locally. About 20 residences in Old Town remain on bagged sewage pick-up at this time.

B.4 Sewage Disposal

At present most of the City's sewage is discharged to Kam Lake which ultimately drains into Great Slave Lake. Some sewage still discharges to Niven Lake. The new system, expected to be operational by the fall of 1981, will utilize the Fiddler's Drainage Area west of the City. When operational, all of Yellowknife's sewage will be discharged into this series of lakes and drainages with ultimate discharge to Great Slave Lake. Work is being completed in the construction of dams to increase the capacity of holding ponds (to increase retention time and treatment capacity). Dams are also being constructed to divert the flow from Trappers Lakes into the Kam Lake drainage such that it will not enter the Fiddler Drainage Area. This drainage area has essentially been designated as a sewage treatment system. Over the following years, the system will be monitored to determine the effectiveness of treatment and if any modification or additions will be required in order to increase its efficiency.

B.5 Garbage Collection and Disposal

Garbage collection is contracted locally to Kavanaugh Bros. Ltd. who utilize a number of back loading type compactor units for regular garbage pick-up. Garbage is disposed at the dump area located about 2 km north of Yellowknife. The City maintains the dump area using a landfill operation.

B.6 Roads and Drainage

Most of the streets within the City are paved with asphalt. The roads outside the built-up area are gravel surfaced. Drainage is handled on the surface through the use of gutters, culverts and ditches. In the built-up areas, drainage is assisted through the use of gutters, catchbasins and storm sewers which ultimately discharge to Great Slave Lake.

B.7 Fire Protection

Fire protection in Yellowknife consists of the following:
2 fire halls
4 fire trucks (4 Triple Combination pumpers, one with aerial)
9 full time staff plus 26 volunteer firemen
Also included are a full time fire chief, emergency vehicle, patrol van, tanker and ambulance.

B.8 Other Services

Other services in Yellowknife include an RCMP detachment, Stanton Yellowknife Hospital, education facilities to grade 12, churches, community centre, library services, museum, 2 radio stations, Anik satellite and cable TV services as well as numerous communication, media, contractor, financial, professional, and property companies plus many local and branch retail and wholesale businesses. NCPC provides power from hydro generation facilities at the Snare Hydro Development north of Yellowknife augmented by diesel generation facilities within the City.

INFORMATION SOURCES

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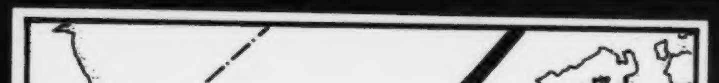
4. Reid Crowther & Partners Limited, *City of Yellowknife - Sewage Disposal Study - Stage II Report,* March 29, 1979.

5. Discussions with Mr. J. Kraft, Development Director and Mr. R. Walton, Engineering Supervisor, City of Yellowknife, Fall 1980.

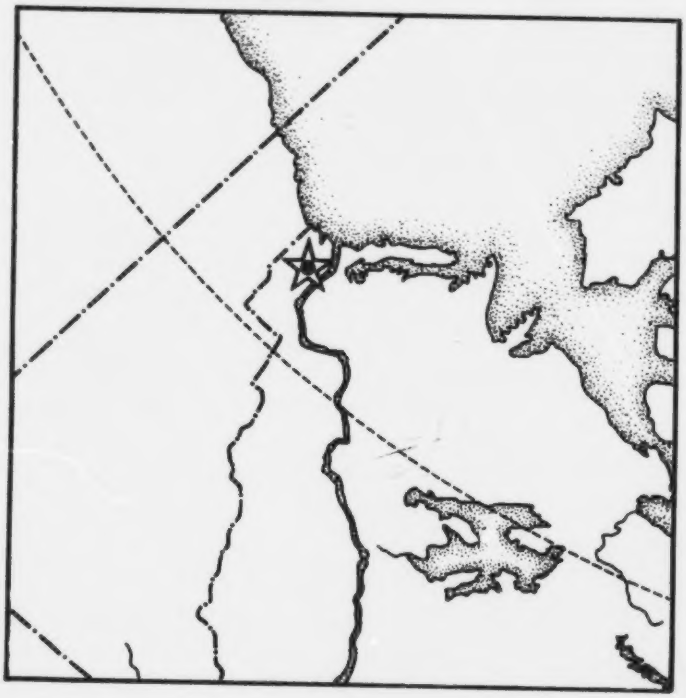
6. DIAND Water Resources Staff - Water Quality Data.

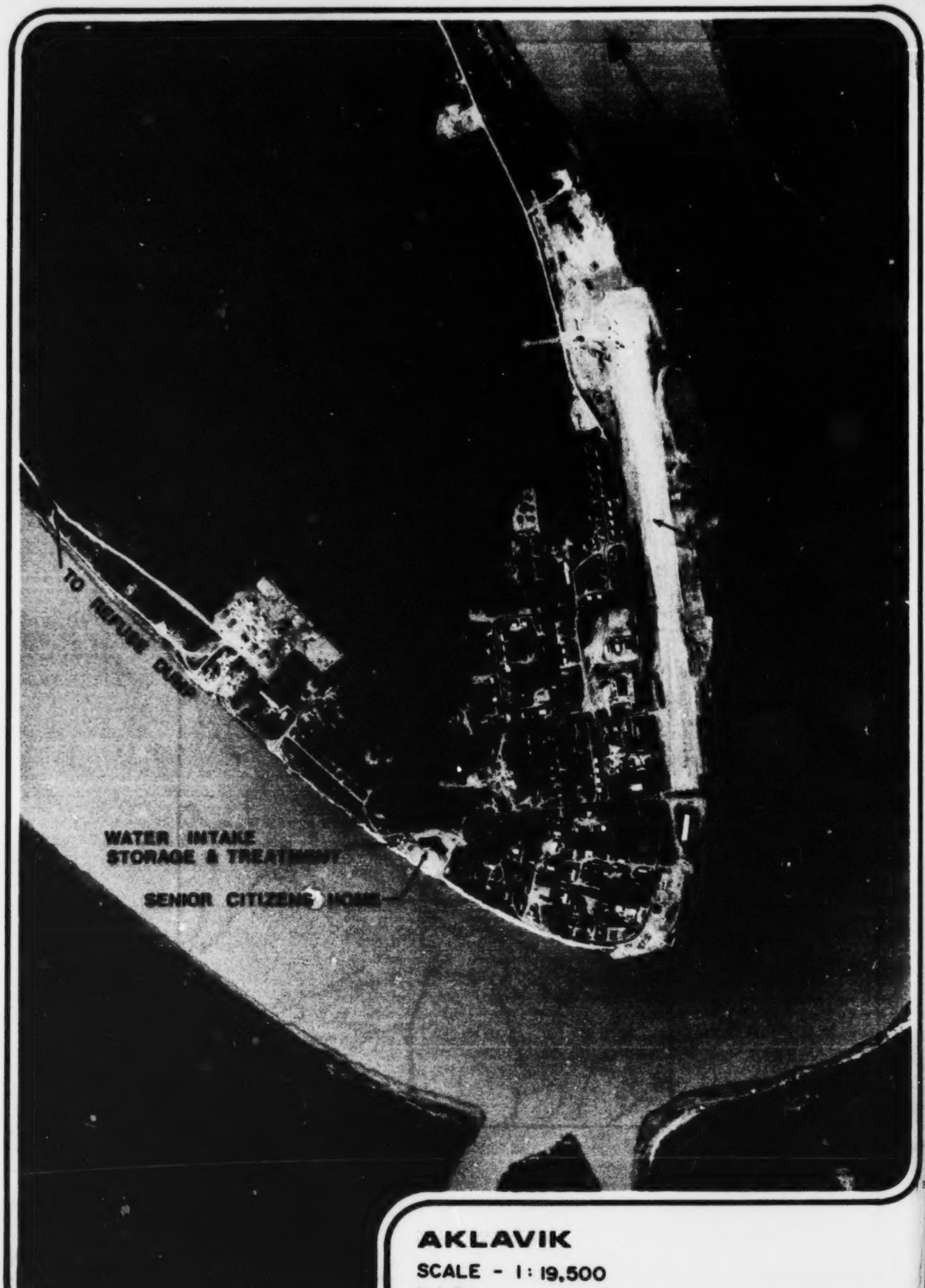
7. Personal communication, Mr. R. Boone, Reid, Crowther & Partners, Yellowknife.

INUVIK REGION



Aklavik




TO REFUSE DUMP
WATER INTAKE
STORAGE & TREATMENT
SENIOR CITIZENS HOME

AKLAVIK

SCALE - 1: 19,500
N.A.P.L.
NO. A25224-142 27/7/79

Aerial photo of community

A. GENERAL

A.1 Location

Aklavik is located on the west shore of the Peel Channel of the Mackenzie River Delta at approximately 68°13'N latitude and 134°59'W longitude. It is about 50 air km north of Fort McPherson and 56 air km west of Inuvik.

A.2 History

Aklavik in Inuit translation means 'The place of the Barren Land Grizzly Bear'. Primarily as a result of its excellent location as a trapping area and key transportation centre, Aklavik became the major community in the Delta area by 1920. Due to serious flooding in the 1950's and other site limitations, the Federal Government decided to move the administration centre to Inuvik. However, this move was only partially successful, as today a predominantly Loucheux and Inuit community is still relatively stable in Aklavik.

A.3 Community Information

In January, 1974, Aklavik achieved Hamlet status. The population has increased slightly from 761 persons in 1978 to 818 in 1980. There has been a general decline in population over the past few years; however, this may in part be related to a recent decline in petroleum exploration activity.

Approximately 88% of the community is comprised of native people and of this portion, about equal numbers are Indian and Inuit.

The economy is based primarily on wage employment with hunting and trapping continuing to play a role in the economy and life style of the community.

Transportation to Aklavik includes air traffic from Inuvik, a winter road from Inuvik and barge traffic from Hay River between June and October. A 914 m long gravel airstrip is located adjacent to the community (elevation: 11 m ASL).

A.4 Geology and Terrain

Aklavik (being within the delta region) is characterized by alluvial desposits of fine sand and silt. The stratified layers extend to about 11 m below the surface. Permafrost is continuous with an active layer varying between 0.3 and 0.9 m thick. The Hamlet is about 3.5 m above summer water level and 10 m above sea level which has resulted in occasional flooding of the settlement.

A.5 Vegetation

This area is within the Boreal forest zone. Upper delta areas are characterized by white spruce on high ground with willows and alders in low lying areas. The lower delta areas include balsam, poplar and black spruce on high ground with willows and alders in low areas. Areas with marshy vegetation and muskeg are typical in low lying land and inland of the tree lined channel banks.

A.6 Climate

Aklavik can experience summer high temperatures of 18.3°C and low temperatures of 8.9°C. The January mean high temperature is -24.9°C while the mean low temperature is -32.7°C (average -9.1°C). The mean total yearly precipitation is 236 mm. Winds are generally from the easterly direction.

B. MUNICIPAL SERVICES

B.1 General

B.1.1 Water Supply

In the recent past the spring break-up and summer water supply for Aklavik has been Pump Lake, located approximately 300 m from the community, while during the fall and winter water was pumped from Peel Channel. Problems with contamination of the lake led to the upgrading of treatment facilities to obtain water from the Peel Channel year- round. The new water treatment plant was completed in 1979. The aerial photo shows the location of the intakes, new water treatment plant and storage facilities.

B.1.2 Source

During spring and summer the Peel Channel has a high silt content. Although high colour and turbidity is a problem in the summer, in the winter the water quality is general good.

Below are some typical chemical analysis results: (All values in mg/L unless otherwise indicated)

	PEEL CHANNEL		PUMP LAKE
	Sept. 9/68	Jan. 15/61	June 6/77
pH	8.1	7.1	8.1
Hardness as $CaCO_3$	184.0	196.6	115.0
Total Alkalinity as $CaCO_3$	136.0	148.0	96.5
Total Iron (Fe)	0.29	<0.05	—
Colour (units)	25.0	<5.0	20.0
Turbidity (units)	15.5	<0.1	2.0
Calcium (Ca)	53.9	51.2	31.7
Magnesium (Mg)	12.0	16.7	—
Potassium Bicarbonate as CO_3	81.6	88.8	—
Filterable Residue on Drying at 105°C	228.0	232.4	—

(Source: Information Source No. 4)

B.1.3 Intake Facilities

The dual intakes into the Peel Channel consists of 250 mm Series 100 HDPE pipe. One intake extends 70 m into the Peel Channel and the head of the other 80 m intake diverges 6 m downstream from the line of the other intake on the river bottom.

A 200 mm Series 45 HDPE insulated waste line extends roughly 27 m from the treatment plant to the river embankment edge.

The insulated intakes are buried 60 m from the building, then continue uninsulated on the river bottom. Concrete pipe anchors are placed at 1.5 m centres from the shore.

The intake stabilizers consist of American Standard Channels (150 mm x 50 mm) welded to 13 mm steel plate.

The insulation where applicable is 75 mm of urethane foam covered with a 20 gauge galvanized jacket and 45 mil polyethylene outer black jacket.

There is a heat trace conduit on the water supply line (buried section) consisting of a 19 m series 160 polyethylene pipe with a self- limiting Chemelex 8 ATV Auto-Trace heat trace cable.

B.1.4 Treatment Facilities

In 1979, a Neptune Water Boy WB 82 package treatment plant was installed in the existing heated insulated building. The facilities are adequate to meet 30 year trucked and piped/trucked demand and are capable of processing 324,000 L/day or 3.75 L/s.

The installation includes a Neptune FTC-25H tube settler/flocculator, a Rapid Mix chamber, a filter area of 1.1 m², a 1-1/2 HP, 4.5 L/s effluent pump and a 5 HP, 16.4 L/s backwash pump. A 13,600 L storage tank is used for backwash and a backwash drainage pit was constructed to accommodate WB-82 and FTC-25H wastes. The water is chlorinated with a Wallace and Tiernan Series 94 Solution Metering Pump.

B.1.5 Pumping Facilities

There are two jacuzzi Series 3S4 x 12, 3 HP, submersible water supply pumps - one for each intake.

The tank circulator pumps are Armstrong 4030, 0.747 KW, (0.76 L/s @ 140 kPa).

The truck fill pump is an Armstrong 2 HP Series 4280 Type 20, 1750 RPM pump with a 208 V, 60 Hz, 3 phase motor. It has a 6.35 cm (2.5") suction and 5 cm (2") discharge.

B.1.6 Storage Facilities

Water is stored in two 227,000 L bolted galvanized storage tanks, one of which was repaired and insulated with 50 mm of urethane foam. Another 81,800 L welded steel tank was removed from the building and is also used for storage. A 75 mm diameter water line leads from the treatment plant to the insulated storage tank just outside. A 38 mm diameter recirculation line is in parallel with it.

B.2 Water Distribution

During the winter water is hauled by a delivery truck equipped with a 4550 L (1000 Igal) tank.

A distribution system of 75 mm and 100 mm iron pipe provides piped water during the summer-months. The pipes are laid on the ground surface and are buried or run through culverts at road crossings. Access to the water is through taps at intervals or by service connections.

In the fall the pipes are disconnected and left in place so as to prevent damage by freezing.

B.3 Sewage Collection

Half of the buildings, including all businesses, have sewage holding tanks which are pumped out once or twice weekly. The other homes use sewage bags which are collected every second day. Only houses with holding tanks dispose of waste water in their tanks. Families without tanks dispose of the wash water in the ground. Sewage pumpout is privately contracted.

B.4 Sewage Disposal

All collected waste is disposed of 4 km west of the community at a site 0.6 km from the river channel. The site includes disposal areas for landfill, bagged sewage and liquid waste (from pumpout).

B.5 Solid Waste Collection Disposal

All waste is picked up by a 7 yard dumptruck under a private contract. Old fuel drums are used for the collection of domestic waste. Each group of barrels serves a number of houses. Collection occurs 2 or 3 times per week and garbage is deposited at the disposal area mentioned above.

B.6 Roads

The main function of roads is for water delivery and sewage pick-up by truck. There are about 6 km of roads in the hamlet and wooden sidewalks connect most portions of the community. Approximately 380 m of new road construction is planned for the 1980 season. A new dump road is planned for the future as well as an additional 520 m of road in the Hamlet.

B.7 Surface Drainage

A drainage improvement program to upgrade the existing ditches is planned for future years. Some lots are poorly drained; other ditches are blocked. There will be a revision of drainage plans, and some culvert and sidewalk improvements.

B.8 Erosion

Erosion of the riverbank on the settlement side of the river has caused some concern with a rate of erosion estimated at 1.22 m per year. Remedial and stabilization work will continue as an ongoing program.

Mackenzie Delta

B.9 Fire Protection
The fire protection facilities in Aklavik consist of the following:

- one (1) portable gasoline pump
- approximately 20 call boxes throughout the community connected to an annunciator panel in the fire hall
- a 1963, 4 x 4 standard triple combination pumper truck which holds 2300 L of water and 68 kg of dry chemical
- approximately 15 volunteer firemen
- in summer there are 4 outlets for firehoses on the water distribution system; in winter the fire truck tank is filled with water as standby for use to combat fires.

B.10 Other Services
Other services in Aklavik include telephone (CNT), CBC Television via Anik Satelite, Mail Service (5 days per week), and regular scheduled air service from Inuvik, NCPC provides diesel generated power with a total installed capacity of 1350 kw.

INFORMATION SOURCES

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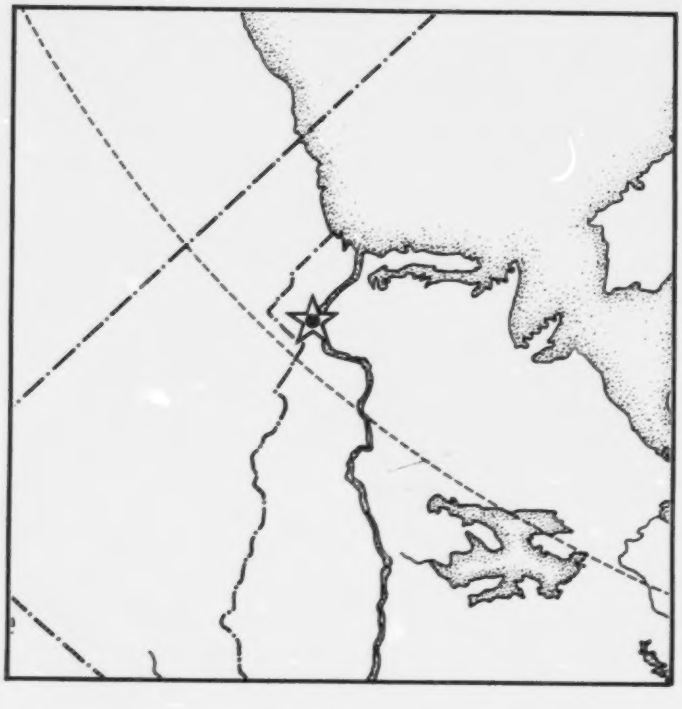
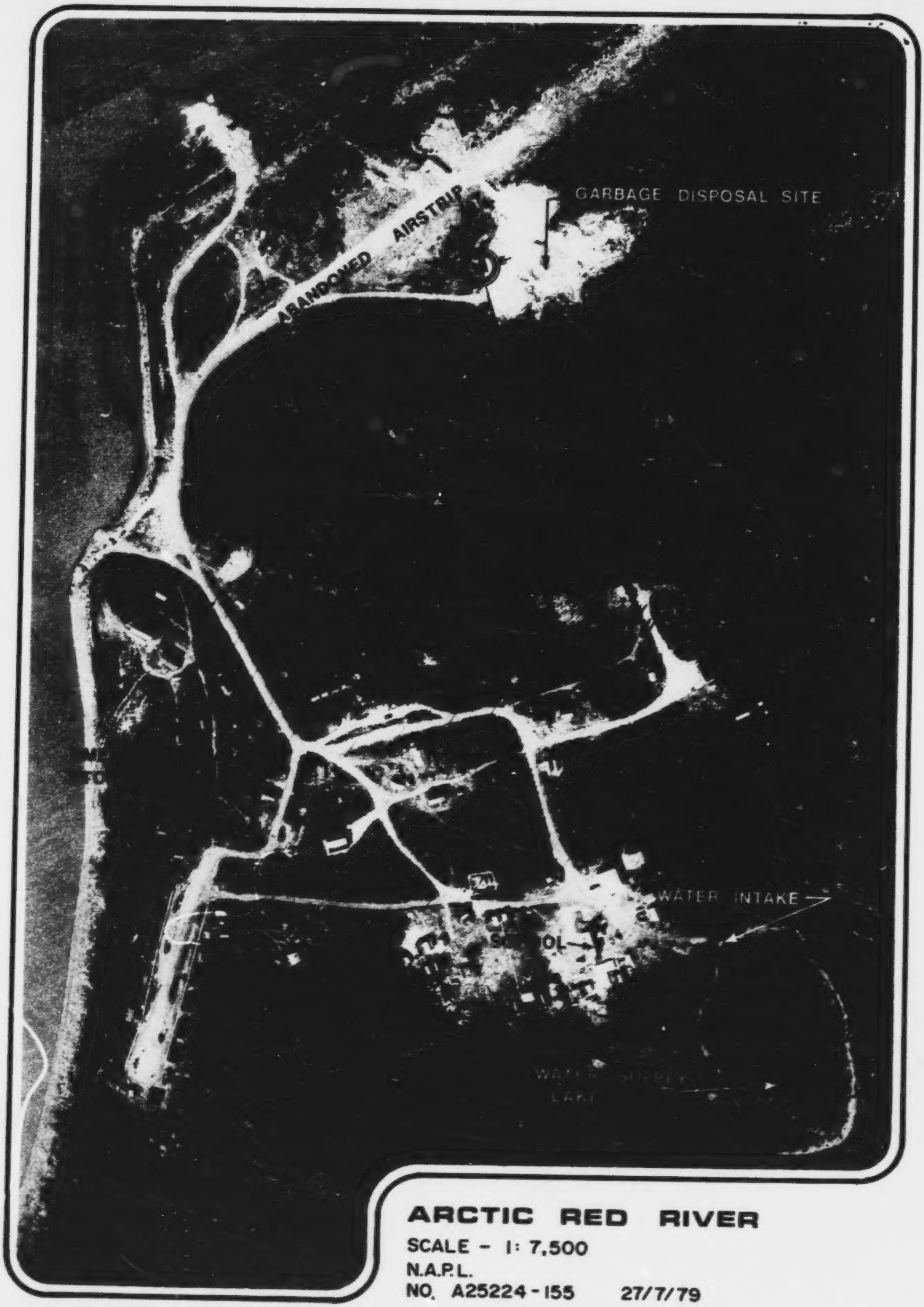
2. Makale, Holloway & Associates Ltd., Planning Consultants, and Associated Engineering Services Ltd., *Aklavik, N.W.T. Development Plan,* April, 1975.

3. Associated Engineering Services Ltd., *Surface Drainage at Aklavik,* 1970.

4. W.J. Francl & Associates, Consulting Engineering Ltd., *Report on a Water Supply Study for Aklavik,* 1975.

Arctic Red River




ABANDONED AIRSTRIP
GARBAGE DISPOSAL SITE
WATER INTAKE
SCHOOL
WATER SUPPLY LAKE

ARCTIC RED RIVER

SCALE - 1: 7,500

N.A.P.L.

NO. A25224-155 27/7/79

A. GENERAL

A.1 Location

Arctic Red River is a small settlement located at the confluence of the Arctic Red and Mackenzie Rivers. A ferry service connecting the community with the Dempster Highway operates near the townsite. The co-ordinates for Arctic Red River are 67°27'N latitude and 133°46'W longitude. It is approximately 109 km southeast of Aklavik by air, 258 km northwest of Fort Good Hope and 1,010 km northwest of Yellowknife.

A Roman Catholic Mission was established at the traditional fishing camp in 1868. A trading post was established two or three years later.

Today, the community's economy depends on trapping, hunting, and fishing with the possibility of some highway related economic potential. At present it has settlement status.

The population has dropped since 1978, partly due to the closing of the Hudson's Bay Store. The statistics are as follows:

POPULATION	YEAR
111	1978
79	1979
98	1980

Most of the residents are Loucheux Indians while about 15% of the population are made up of Metis and Whites. Freight is barged from Hay River and there are regular flights from Inuvik. At the moment, no usable airstrip exists for the settlement although an abandoned strip is situated adjacent to the river.

The townsite is built on fluvial glacial terraces. As the land rises from both rivers, the area is well drained. The dwellings are from 7.5 m to 30.5 m above the river level.

Water intake

Surface material is a mixture of gravel, sand and fine sediments with outcrops of sandstone and shale. Underneath is a layer of sandy or silty clay. These unconsolidated materials have a thickness of 7.5 to 9 m and are underlain by Devonian shale.

Arctic Red River is in the continuous permafrost zone. The active layer is 0.3 to 0.5 m deep.

Black spruce and birch grow on the well-drained land, while willow grows in the poorly drained areas. A local sawmill, now shut down, used the large areas of scrub forest nearby as a source of wood. The community itself, however, is devoid of trees.

The ice on the rivers breaks up in June. The rivers are frozen again by November. Snowfall averages 1608 mm while the area has a mean of 135 mm of rain. Prevailing winds are from the east at an average of 9.6 km/h.

The July mean high and low temperatures are 19.9°C and 9.4°C. January, the coldest month, has mean high and low temperatures of -24.9°C and -32.7°C respectively.

Arctic Red River summer view

B. MUNICIPAL SERVICES

B.1 Water Supply

Arctic Red River has two sources of water. From the end of May to mid-November when turbidity levels are high in Arctic Red River, the major source of water supply, water is pumped from a small lake 60 m east of the school. The catchment area for the lake overlaps the townsite and there exists a risk of pollution from surface run-off, specifically from the NCPC fuel oil storage facility 100 m northwest of the lake.

Another lake at the north end of the settlement is not suitable for water supply because the general townsite drainage is into the lake.

Samples from the water supply lake and Arctic Red River were anlaysed in October, 1974. (Ref. No. 4). Below are the analysis results. (All values in mg/L unless otherwise indicated)

	Arctic Red River	Water Supply Lake
pH	7.86	7.52
Total Dissolved Solids	227	160
Calcium (Ca)	45	23
Magnesium (Mg)	16	7
Bicarbonate (HCO_3)	132	110
Alkalinity Total as ($CaCO_3$)	108	90
Sulphate (SO_4)	76	6
Total Hardness as ($CaCO_3$)	178	86
Iron as Received (Fe)	1.70	0.12
Colour	25 units	45 units
Nitrate (NO_3)	<0.5	<0.5
Turbidity	47 JTU	12 JTU

The Arctic Red River requires treatment for colour and turbidity but is as good a source for water as the Mackenzie River. The latter is further from the community, hence the use of the Arctic Red.

Summer community water storage tank

B.2 Water Distribution

Water is collected directly from the lake and distributed by means of a water tank which is skid mounted in the winter, put on wheels in the summer, and pulled by a TD-9 tractor. The tank holds 2275 L (500 Igal). Water is delivered once a week to the buildings, each of which is equipped with a 1135 L (250 gal) fibreglass tank. Some houses are not accessible by vehicle and must obtain water from the tank via an aluminum 'victaulic' pipeline (1978).

Water is batch chlorinated in the delivery tank of the water delivery vehicle before delivery.

A 4500 L (1000 Igal) fibreglass water storage tank is located in the middle of the community to be used by residents when the water truck breaks down or roads are impassable.

B.3 Sewage Collection

Bagged sewage, the only form of sewage disposal, is collected once a week by a TD-9 tractor.

B.4 Sewage and Solid Waste Disposal

The disposal area is located on a floodplain of the Mackenzie River northeast of the settlement about 275 m from the nearest residence. The site is burned over at intervals and is generally well maintained.

B.5 Roads

Roads are presently little more than paths throughout the community. The Dempster Highway gives Arctic Red River residents greater accessibility to Inuvik, Fort McPherson and the Yukon.

B.6 Fire Protection

Call boxes throughout the community are directly connected to a siren. The firetruck is a 1972 tracked mini-pumper. There are approximately 10 volunteer firemen.

B.7 Other Services

- Telephone: CNT microwave
- Mail Service: at HBC
- Power: NCPC - 287KW generator

INFORMATION SOURCES

1. Ministry of Transport, Airports Branch, *Arctic Airport Master Plan,* Arctic Red River, N.W.T., 1975.

2. Doug Naylor, Dept. of Highways and Public Works, G.N.W.T., *Initial Comments on Arctic Red River Pre-design Study,* November, 1979.

3. Robert M. Bone and Roman T. Gajden, Geographical Branch, Dept. of Mines and Technical Surveys, *Arctic Red River District of Mackenzie, Terrain and Site Analysis,* March, 1963, Ottawa.

4. Stanley Associates Engineering Ltd., *Arctic Red River, Needs and Demands Study,* April, 1974.

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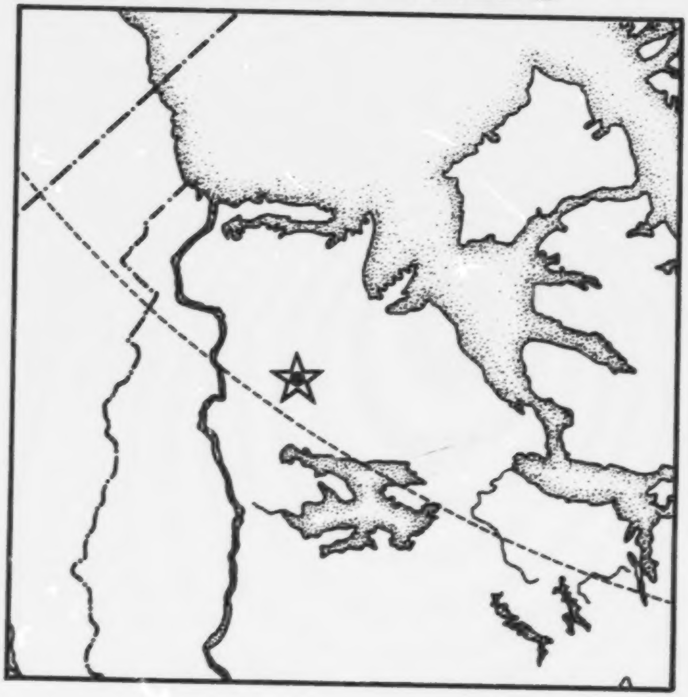
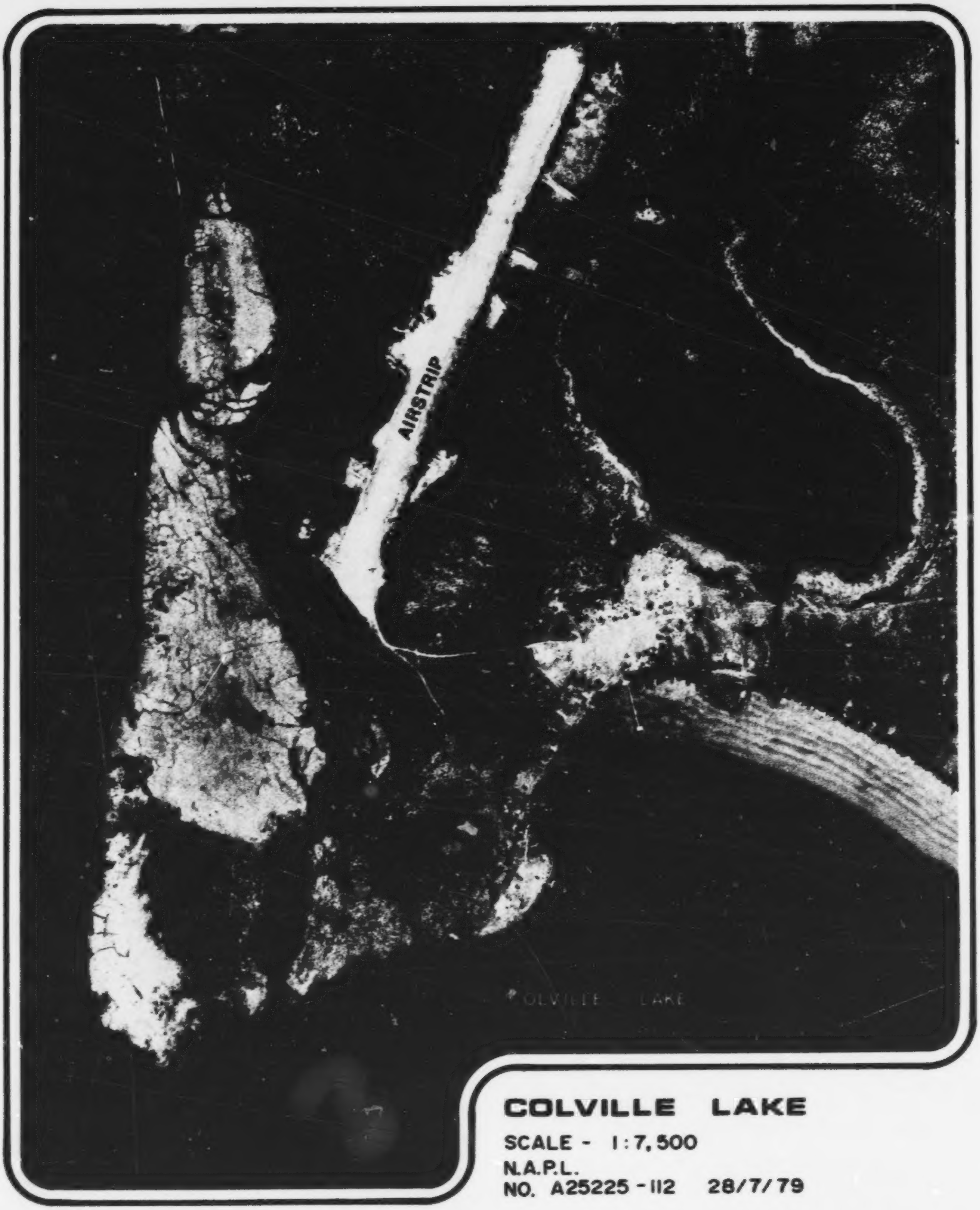
Colville Lake




AIRSTRIP
COLVILLE LAKE

COLVILLE LAKE

SCALE - 1:7,500
N.A.P.L.
NO. A25225-112 28/7/79

Log houses in community

A. GENERAL

The unorganized community of Colville Lake is situated on the southeast shore of Colville Lake 745 km by air northwest of Yellowknife. Its co-ordinates are 67°02'N and 126°07'W.

The settlement was organized in 1962 with the establishment of a Roman Catholic Mission.

The majority of the 75 residents are Hareskin Indians. The major activities are hunting, fishing and trapping. Commercial enterprises include the Kapami Co-operative Association and the Colville Lake Lodge.

The only community facilities of any significance are a health station and Roman Catholic Church. Schooling is provided in Inuvik.

An 820 m sand airstrip is located adjacent to the community for use by small aircraft. The surficial materials in the area of Colville Lake generally consist of pleistocene sediments such as sand, gravels, clays and tills. It is in an area of continuous permafrost.

The community is at a location approaching the northern limit of trees. As such, the black spruce tend to be small and sparse. Other vegetation typically includes mosses, lichens, grasses and alders.

The climate is much like that of Fort Good Hope to the north. The mean high temperature in July is 22.9°C and the mean low is 7.6°C. The January mean high is -25.6°C and the mean low is -34.4°C. About 262 mm of precipitation occurs in the Colville Lake area each year. An average of 147 mm of this falls as rain. The mean snowfall amounts to 1151 mm per year.

B. MUNICIPAL SERVICES

B.1 Water Supply

Water is hauled using buckets from Colville Lake. The water is not treated in any way. In winter, ice is melted or water is taken from beneath the lake ice. There is no organized system of delivery.

B.2 Sewage Collection and Disposal

Every residence has a privy. There is no other form of sewage disposal. Wash water is dumped onto the ground outside residences.

B.3 Solid Waste Collection and Disposal

A dump is located nearby but garbage collection and disposal are handled by individual residents.

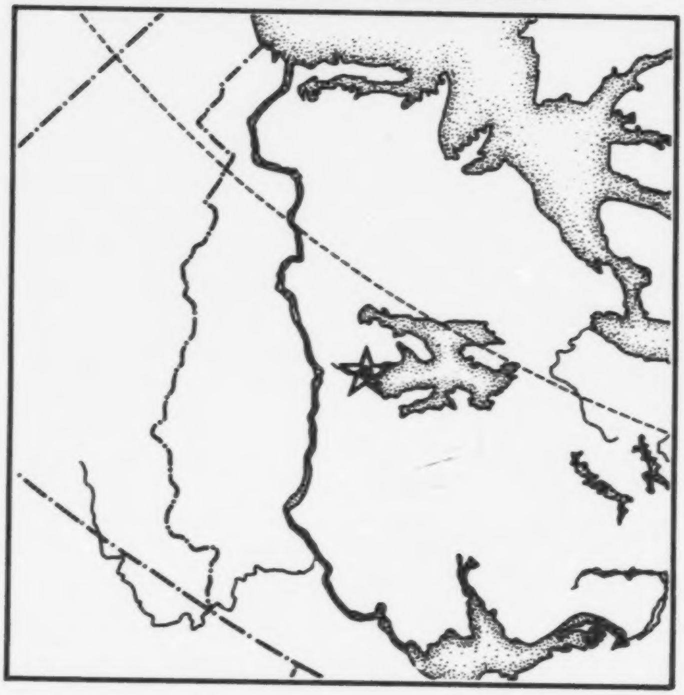
B.4 Roads and Surface Drainage

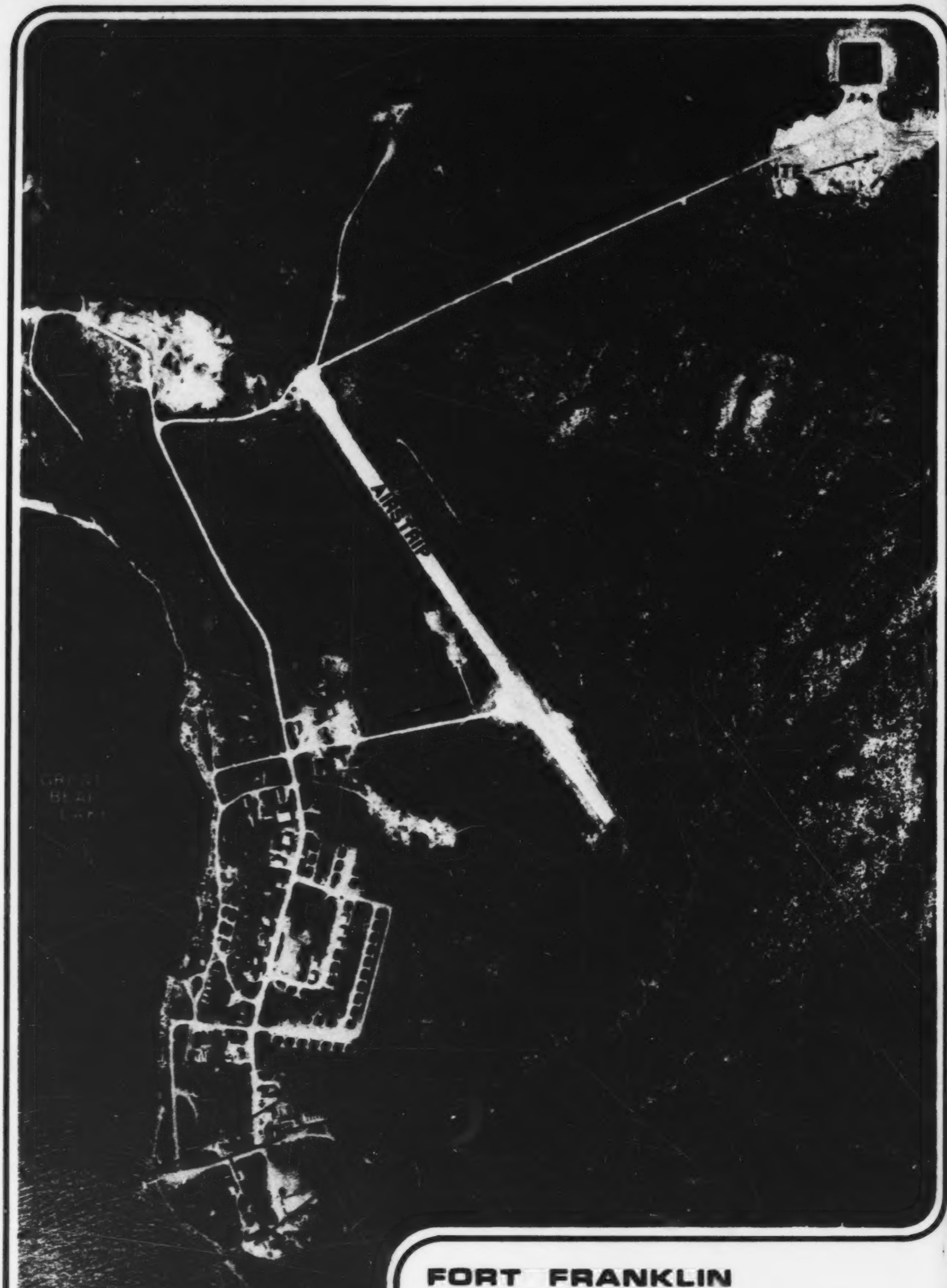
Trails have formed due to habitual use. There are no roads in the community. Drainage is poor due to the flat low-lying nature of the site.

B.5 Fire Protection

Fire extinguishers and buckets of water are the only forms of fire protection within the community.

Fort Franklin




AIRSTRIP
GREAT BEAR LAKE

FORT FRANKLIN

SCALE - 1:8,500

N.A.P.L
NO. A25225-144 & 146 28/7/79

Aerial view of hamlet

A. GENERAL

A.1 Location

Fort Franklin is geographically located at latitude 65°11'N and 123°26'W approximately 540 air km northwest of Yellowknife at the southwest end of Great Bear Lake. It extends along the north shore of Keith Arm, about four miles from the head of Great Bear River which empties into the Mackenzie River near Fort Norman.

A.2 History

Fort Franklin was first established in 1825 when Sir John Franklin used it as a base for his exploration activities. With the discovery of pitchblende, silver and other minerals at Port Radium and petroleum at Norman Wells in the 1920's, Great Bear Lake and River became important as a commercial transportation route. The Hare Indian people finally settled in Fort Franklin after the establishment of a Roman Catholic Mission and Federal Day School and Hudson's Bay Post in 1949-1950.

A.3 Community Information

In 1975 the community achieved Hamlet status. In recent years the population has increased from 512 in 1978 to 545 in 1980. A steady growth rate of about 2% per year is expected over the next few years.

The economy of Fort Franklin is based primarily on lake fishing and fur trapping. The Territorial Government, Hamlet Government, a local Co-op and the Sah-Tew Lodge also provide some wage employment. Services include a Nursing Station, Public School, Roman Catholic Church and recreation facilities. A 762 m gravel airstrip is located immediately north of the community (elevation 168 m ASL).

A.4 Geology and Terrain

Although rock outcrops do occur in the area, none are apparent in the immediate settlement area. It is known, however, that sedimentary rocks of the cretaceous period exist beneath recent and deep glacial and lacustrine deposits. The settlement is sited on a relatively level area of unconsolidated material consisting of lake deposits of silt, sand and clay as well as offshore bar deposits. Extensive sand and gravel ridges surround the settlement.

Surface materials generally consist of mosses and organic matter (150- 600 mm thick), underlain by course sand or gravels. Permafrost may generally be encountered from 400 to 700 mm beneath the ground surface depending on surface materials and drainage.

A.5 Vegetation

Fort Franklin lies just south of the tree line. A scattered black spruce-tamarack association is found in the region with numerous open areas covered with bunch grasses, mosses and lichens. Within the open forest an undergrowth of alder is also found. Willow scrubs are common in poorly drained areas.

A.6 Climate

Fort Franklin generally experiences a typical Arctic climate with temperatures below freezing for about seven months per year. Typical summer temperatures are 12°C with winter temperatures averaging -26°C. Winds are generally from the northeast. Rainfall averages 193 mm and snowfall averages 1,364 mm per year.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Great Bear Lake is the source of domestic water for the community. In the past, water was hand-hauled by bucket for use in the homes or by water haulage tankage tank from the dock. Problems with water contamination and inconvenience led to the construction of improved supply facilities in 1970. These consisted of a short intake line extending into Great Bear Lake connected to a wet well located at the dock. The water was pumped to a storage tank where it was distributed by truck to most of the houses and also by utilidor to the school and a few other buildings. The distribution system is still in operation.

Problems with the supply system prevailed, however, due to the short intake line in shallow water which was susceptible to contamination from surface run-off as well as turbidity caused by wave action. Also, the system could not operate year-round due to freezing of the intake and wet well. Accordingly, construction on a new intake, wet well and pumping facilities began in 1979 and was completed in 1980. The new system is described in the following sections.

B.1.2 Source

For use as a domestic water source, Great Bear Lake is of good quality. A summary of a typical chemical analysis is as follows: (All values in mg/L unless otherwise indicated)

Parameter	
pH	7.9
Total Hardness as ($CaCO_3$)	75
Total alkalinity as $CaCO_3$	66
Total Iron (Fe)	0.01
Total Manganese (Mn)	0.01
Colour	5.0 units
Turbidity	0.6 units
Nitrate Nitrogen (N)	0.2
Calcium (Ca)	18.3
Magnesium (Mg)	7.1
Sodium (Na)	6.8
Sulphate (SO_4)	13.2
Chloride (C1)	7.0
Fluoride (F)	0.17
Total Dissolved Solids	99.6

B.1.3 Intake Facilities

The intake facility exends out from the dock area into Great Bear Lake (see aerial photo).

Length (wet well to screen):	229 m
Diameter:	168 m
Material:	polyethylene, Series 100

Reinforced concrete ballast blocks are placed at a 1.5 m spacing on the underwater portion of the pipe, (approximately 140 m). The intake structure consists of an all-welded continuous slot construction stainless steel screen as manufactured by Johnson. It is positioned approximately 6 m below the low water level of Great Bear Lake. The underground position of the intake line (89 m) has 25 mm of urethane insulation with yellow jacket covering. A trace heat carrier pipe with heat trace cable is located within the pipe (Chemelex 'Auto Trace' - 13 watts/m rating).

The intake is connected to a wet well located at the pumphouse.

Wet Well

Dimensions:	1800 mm x 2520 mm deep
Construction :	250 mm reinforced concrete walls
Insulation:	150 mm styrofoam on outside of walls

B.1.4 Treatment

Due to the good water quality available from the lake, only chlorination is provided. The chlorination equipment consists of two Wallace And Tiernan Model 745 hypochlorinators, each capable of meeting maximum demand requirements.

B.1.5 Pumping Facilities

Two similar pumps are provided; one supplies the storage tank at the water storage building and the other is used for loading the water delivery truck at the pumphouse.

Pump specifications are as follows:

Storage Tank Loading Pump:

Type and Model:	Jacuzzi, Model 356J3, centrifugal
Capacity:	5 L/s @ 194 kPa TDH (67 Igpm @ 65' TDH)
Motor:	3 HP, 208 volt, 3 phase, 60 Hz.

Truck Loading Pump:

Type and Model:	Jacuzzi, Model 356J3, centrifugal
Capacity:	7.5 L/s @ 105 kPa TDH (100 Igpm @ 35' TDH)
Motor:	3 HP, 208 volt, 3 phase, 60 Hz.

B.1.6 Storage Facilities

Water is pumped to the storage tank via 25 mm diameter heat traced supply line which is enclosed in a 75 mm diameter insulated polyethylene return line. The supply line is 186 mm long and extends from the pumphouse to the water storage building.

The water storage building houses a 68,000 L galvanized water storage tank. The building also contains a heat exchanger, boiler, and a unit heater to heat the water in the storage tank as well as the building.

B.2 Water Distribution

B.2.1 General

A cost effective analysis study on water supply alternatives was completed in 1979. This report by W.L. Wardrop and associates, Engineering Consultants indicates that a fully trucked water supply is the most cost effective alternative for Fort Franklin. The existing piped system will continue to operate until major upgrading is required, at which time, the system will probably be abandoned. The water consumption figure upon which the present design is based are as follows:

Fully Trucked System:

Water Consumption:	32.5 Lpcd (7.15 Igpcd) for 1978 plus an 11.4 Lpcd (2.5 Igpcd) per year increase to 1983.

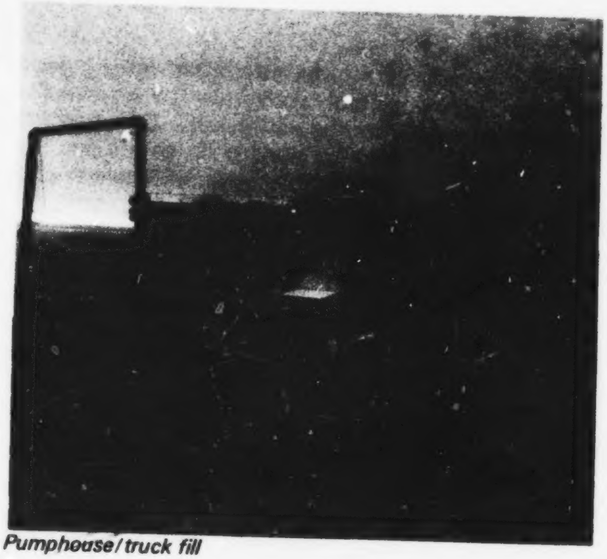
B.2.2 Piped System

The piped distribution system consists of a circulating pump at the water storage building; one supplies water to a 75 mm diameter water distribution line which serves the school, hospital and the residences in between.

Integral with the system is a 50 mm diameter recirculation line for protection against freezing. A second circulating pump of similar capacity which supplies water to the truck fill line will be abandoned with the new truck fill point being installed at the pumphouse. The recirculating pumps are manufactured by Clark Stork (size 63.5 mm x 63.5 mm - 3.5 HP).

B.2.3 Trucked System

Water is presently being obtained from the storage tank facilities for truck delivery. When the new system, scheduled for completion in the summer of 1980, is put into operation, trucks will obtain water from the truck fill point at the new pumphouse located near the dock.



Pumphouse/truck fill

A sample of the projected water consumption figures to 1985 are as follows:

YEAR	POPULATION	FULLY TRUCKED (Igpcd)	FULLY TRUCKED 10^6 gal/yr.	PARTIALLY PIPED (Igpcd)	PARTIALLY PIPED 10^6 gal/yr.
1979	472	40.0	1.72	14.6	2.51
1980	482	12.5	2.19	16.5	2.90
1981	492	15.0	2.69	18.0	3.24
1982	501	17.5	3.20	20.1	3.68
1983	511	20.0	3.73	21.7	4.04
1984	522	22.7	4.33	23.8	4.54
1985	532	22.8	4.43	23.9	4.64

The actual water consumption of the community is currently between 23 and 45 Lpcd (5 to 10 Igpcd).

B.3 Sewage Collection

All of the sanitary sewage in Fort Franklin is collected by means of sewage pumpout and bagged sewage pick-up.

The school, hospital and residences in between have sewage holding tanks. The Government of the Northwest Territories has a labour contract with a local individual to collect the sewage from the tanks and dispose of the sewage at the sewage lagoon.

Bagged sewage is collected under a labour contract with the Government of the N.W.T. The contract also includes garbage pick-up and disposal.

B.4 Sewage Disposal

B.4.1 General

The community has experienced problems over the years with a series of small, poorly constructed lagoon cells built in locations which were subject to natural drainage problems. A sewage lagoon built in 1965 east of the school was abandoned shortly thereafter. In 1969, a lagoon system called the west lagoon system was constructed northwest of the airstrip. This received bagged and pumped sewage, which, due to its small size and nature of soil materials, overflowed and drained to Airplane Lake each spring.

In 1972, construction was attempted on a lagoon just east of the school which was to receive the pumped sewage from the community. Construction was abandoned due to poor soils conditions for construction and inundations with surface run-off.

In 1977, a lagoon system was constructed northwest of the Town and is presently in use.

B.4.2 Sewage Lagoon

Liquid sewage is trucked to the sewage lagoon located about 1.7 km northwest of the community by road. The lagoon was constructed in 1977 under a local labour contract. The cell is designed to store sewage over the winter months. During the summer, the sewage may filter out of the lagoon to some extent. If exfiltration does not occur, and the unit seals itself, drawdown will be required in the fall. The cell has a depth ranging from 2.1 m to 3.2 m and is approximately 70 m by 70 m (center of berm top measurements). The total volume at the 1.52 m (5 ft.) depth is approximately 5.5 million litres. The lagoon was constructed using native sandy silt materials.

B.4.3 Bagged Sewage Disposal

The site as shown on the aerial photo, about 1.3 km west of the community is used as a disposal site for bagged sewage. It is proposed to continue using this area until such time as it becomes full. The site would then be covered with fill and then garbage disposal area would be used until such time as the community converts completely to holding tanks and a trucked sewage collection system.

B.5 Solid Waste Disposal

Solid wastes are collected under a local labour contract with the Government of the N.W.T. and the site northwest of the community adjacent to the sewage lagoons is used as a disposal area (see aerial photo).

B.6 Roads

The roads within Fort Franklin are surfaced with gravel. Regular maintenance is required due to relative instability of the underlying materials. Drainage problems also contribute to some degradation of the roadways.

B.7 Drainage

Drainage at the settlement is generally poor. The ground slopes gently towards the lake throughout the length of the community from a swampy area to the north. Water travels on the surface or through the surface humus on top of the frozen subsurface to the lake. As a result, the ground in the area is generally wet throughout the summer months.

Some attempts have been made to collect and direct the water around and through the community by constructing drainage ditches. These efforts have been partly successful in some cases, however, it remains a significant problem.

B.8 Fire Protection

The fire protection system in Fort Franklin consists of the following:

- multi-zone alarm system, 9 call boxes throughout the Hamlet connected to an annunciator panel at the fire hall office
- one standard triple combination pumper fire truck (mfg. 1965)
- 12 man volunteer fire brigade

B.9 Other Services

Other services include local radio, telephone Northwestel via microwave, mail service 3 times per week and CBC radio and T.V. from Inuvik. NCPC provides power by diesel generation.

INFORMATION SOURCES

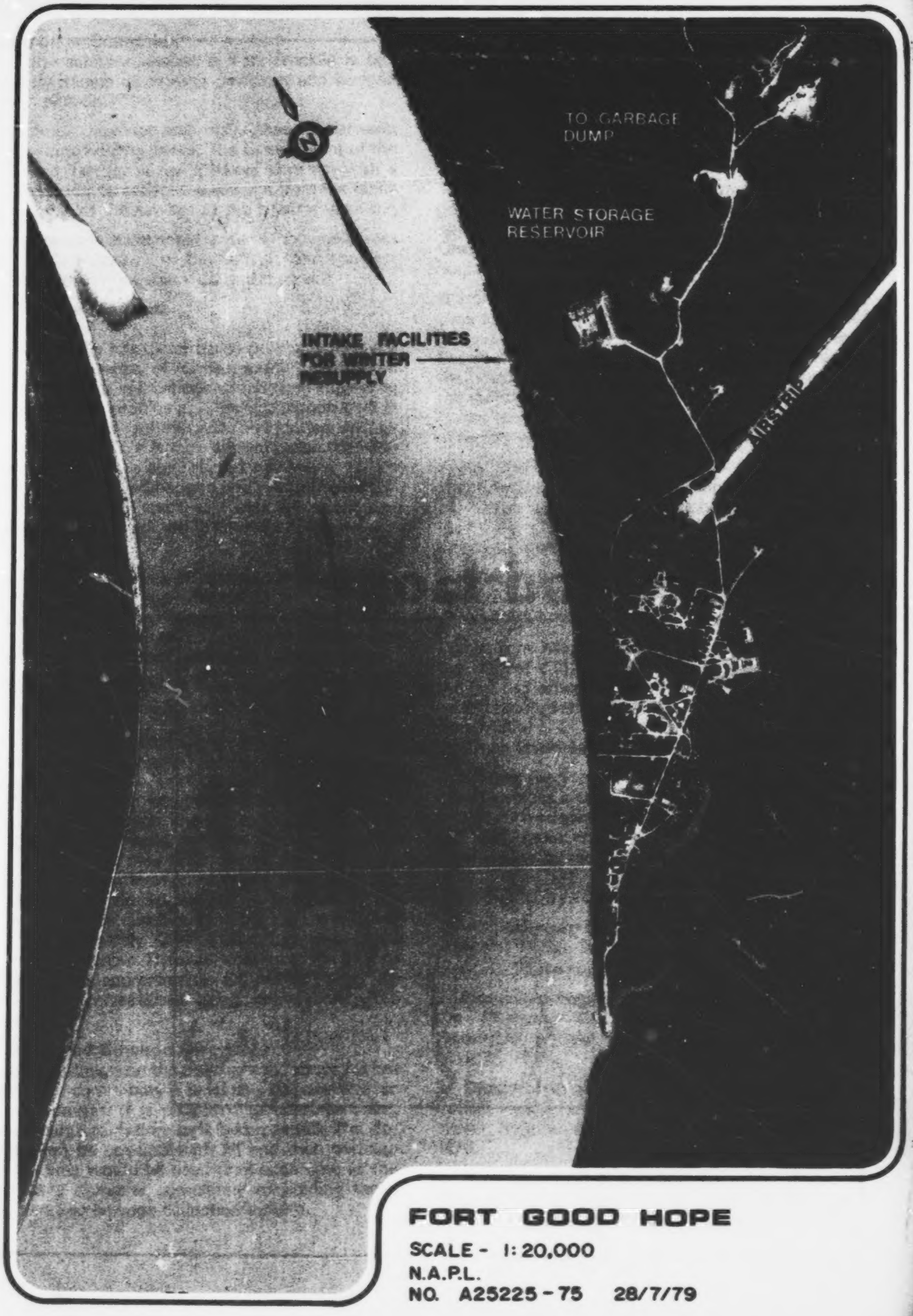
1. W.L. Wardrop & Associates Ltd., *Cost Effective Analysis, Water Supply Alternatives, Fort Franklin, N.W.T.,* September, 1979.

2. Associated Engineering Services Ltd., *Report to the Minister, Northern Affairs and National Resources on the Settlement of Fort Franklin, N.W.T.,* 1963.

3. Department of National Health and Welfare, Public Health Engineering Division, *Report Re: Water Supply, Fort Franklin, N.W.T.,* April 15, 1970.

4. Department of Mines and Technical Surveys, Geographical Branch, *Ter rain and Site Analysis, Fort Franklin, N.W.T.,* 1962.

Fort Good Hope


N
TO GARBAGE DUMP
WATER STORAGE RESERVOIR
INTAKE FACILITIES FOR WINTER RESUPPLY
AIRSTRIP

FORT GOOD HOPE

SCALE - 1: 20,000
N.A.P.L.
NO. A25225 - 75 28/7/79

A. GENERAL

A.1 Location

Fort Good Hope lies on a peninsula between Jackfish Creek and the east bank of the Mackenzie River at their confluence. The co-ordinates are 66°15'N latitude and 128°31'W longitude. The settlement is approximately 30 air km south of the Arctic Circle, 145 km northwest of Norman Wells and 800 air km northwest of Yellowknife.

A.2 History

The settlement has the distinction of being the oldest in the lower Mackenzie River Valley. Established in 1805 by the Northwest Company, it was taken over a number of times before being rebuilt at its present site in 1839. Father Emile Petitot, the noted missionary and explorer, was stationed at the Fort in 1865 after he succeeded in forging a perpetual peace between the Loucheux Indians and the Eskimos in 1860.

A.3 Community Information

The Indians of the Hare tribe form the basis of this community with settlement status. Approximately 15% of the population is made up of Metis and Southern Caucasians.

Only about 15 locals are employed, while the rest receive welfare supplemented by trapping in the winter.

The population has remained relatively stable over the period 1977- 1979 at 446 persons, increasing by only 14 persons to 460 by 1980. Services include a nursing station, primary school, recreation hall, the Roman Catholic Mission, the Pentecostal Church and a Hudson's Bay store.

A 914 m x 30 m airstrip is located just north of the settlement. The sand and gravel surfaced runway is at elevation 65.5 m ASL.

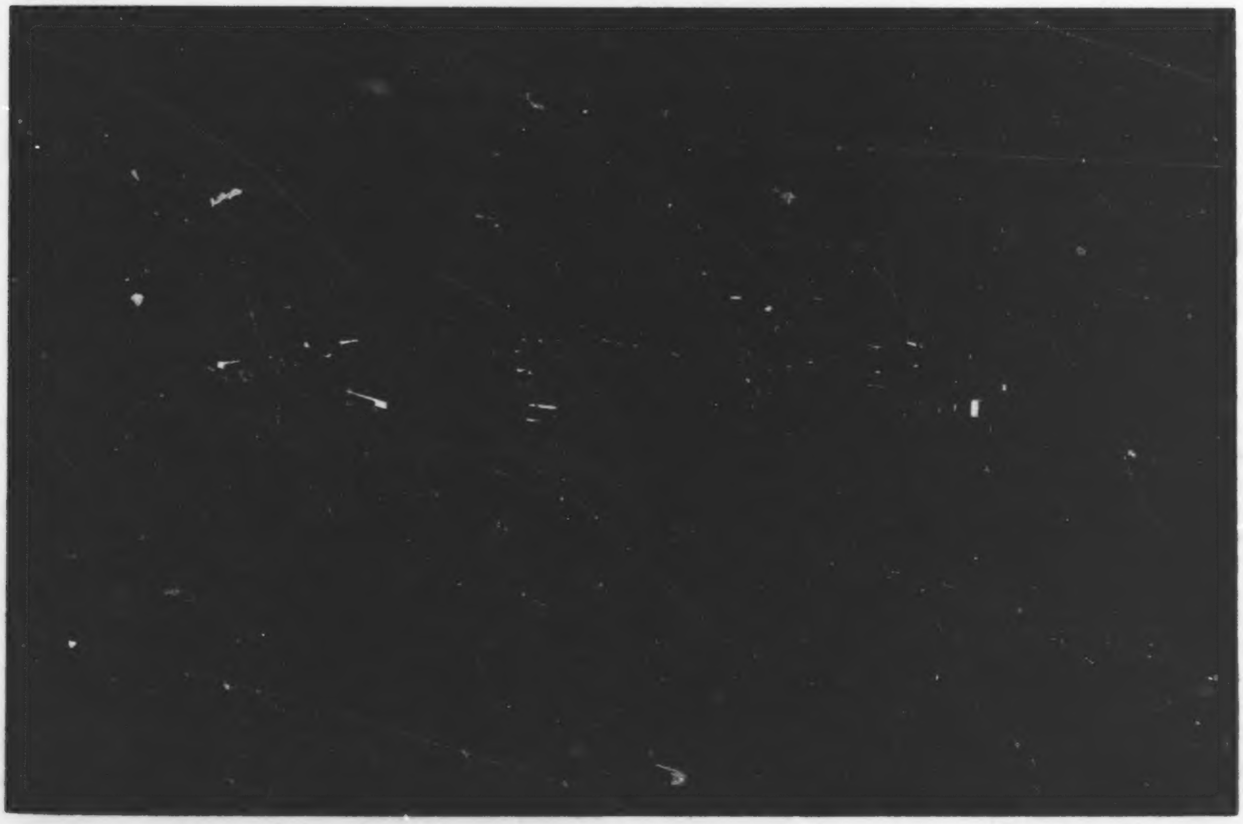
A.4 Geology and Terrain

The community is located on a gravel bar rising from 18 m above the river at the junction of the Mackenzie and Jackfish Creek, to 30 m at the north end of the settlement. Fort Good Hope lies within the continuous permafrost zone. In summer the permafrost is encountered 0.5 - 1.2 m below the ground surface. The area is underlain by glacial and fluvial deposits above Devonian shales and limestone. Fort Good Hope is one of the few communities in the N.W.T. with an adequate supply of good concrete gravel. One such source is 2.6 km north of the community by road.

A.5 Vegetation

The terrain consists of tree covered areas, muskeg and swamp. In well drained granular areas a mixture of spruce, pine and poplar grow to 12 m in height. Poorly drained areas are covered with stunted black spruce and 0.3 - 0.6 m of mossy organic material.

Aerial view



Fort Good Hope Church

A.6 Climate

The summer high and low temperatures average 22.4°C and 9.3°C respectively. The January mean highs and lows are -25.7°C and -34.3°C with an average of -7.6°C. The total yearly precipitation averages 267.2 mm with rainfall making up 149.6 mm of this amount.

B. MUNICIPAL SERVICES

B.1 General

The community has had numerous problems with their water supply. From October to April, the Mackenzie River provided good quality water; however, the turbidity levels in the summer months necessitated the summer use of a shallow lake or a wet well 1.6 and 1.1 km respectively north of the community. A nearby garbage dump contaminated the well area and lake, and the subsequent lake sources since 1973 provided barely potable water. In 1979-1980 a reservoir was constructed to provide water for the settlement year-round. The reservoir is filled in winter and early spring from the Mackenzie River using a portable pump placed on the river ice with a combination above/below ground fill line. Water is distributed by truck from the reservoir pumphouse to the community.

B.2.1 Source

The Mackenzie River provides water of excellent quality from mid-October to mid-April when turbidity levels are low. Fort Good Hope now fills its reservoir when the ice is thick enough to support a portable pumping equipment. Following is a summary of chemial analysis results which show the range of values that can be expected for a few constituents in the water. (all values in mg/l unless otherwise noted)

Constituent	**Values**	
	Low	**High**
Colour	20	200
Turbidity	4	680
pH	7.6	8.2
Alkalinity ($CaCO_3$)	72	97
Hardness ($CaCO_3$)	114	126
Iron (Fe)	<0.01	0.28
Total Dissolved Solids	109	150

(From NAQUADAT, Water Quality Branch, Inland Waters Directorate, DOE -summaries of sampling between 19/06/60 to 01/06/71)

Two components, colour and turbidity can be seen to be extremely high and exceed minimum acceptable limits for drinking water during spring and summer. During the winter, all chemical constituents are generally less than those defined in the Canadian Drinking Water Standards and Objectives, except for colour at times. However, since the colour is not considered to be a serious aesthetic problem in this case, no additional treatment was considered to be warranted.

B.2.2 Intake and Pumping Facilities at River

The elevation difference between the pumphouse by the reservoir and the river is approximately 40 m. A portable pump is set up on the ice in December or January to fill the reservoir.

About 256 m of 168 mm Series 100 polyethylene pipe is buried from the pumphouse to the river bank. It is trace-heated, insulated with 50 mm of urethane, and covered with a black jacket.

One hundred metres of Dupont Gacard Type 13 water hose 150 mm in diameter extends from the buried line to the river bank where it is connected to the portable pumphouse and hose at fill times.

View of community

From the river bank to the portable pumphouse, a 60 m long, 168 mm diameter Series 100 polyethylene pipe with 25 mm of urethane insulation and 20 gauge aluminum outer sheath is attached for filling.

The portable river pumping unit is designed to be towed onto the ice of the Mackenzie River, where a suction line is dropped through a hole to about 4 m below the ice surface. The pump is a Monarch Model 90MT driven by a Ford 2710 diesel engine. The pump and engine are enclosed in a skid mounted insulated shed. The pump capacity is 1,600 l/min.

B.2.3 Intake and Pumping at Reservoir

Two pump casings, a sub-drain monitor line and a fill line are buried from the main pumphouse to the reservoir.

Fill Line:	168 mm diameter Series 100 heat traced polyethylene pipe with 50 mm urethane insulation and covered by a yellow jacket.
Pump Casings:	250 mm diameter Series 45 heat traced polyethylene pipe with 25 mm urethane insulation and covered by a yellow jacket.
Sub-drain Monitor:	50 mm diameter Series 45 polyethylene line with 25 mm urethane insulation and yellow jacket.

The two reservoir pumps consist of Peerless Model 6LB vertical submersible pumps with a capacity of 455 l/min each @ 224 kPa (100 igpm @ 75 ft. TDH).

B.2.3 Storage Facilities

The new reservoir built in 1979 is located about 700 m northeast of the settlement between the airstrip and the east side of the Mackenzie River (see aerial photo). The lined earthen reservoir has a usable volume of 10.9 million litres and is about 93 m square.

The reservoir has the following additional features:

1. There is a sub-drainage system under the reservoir to guard against ballooning of the liner due to a high water table. Perforated corrugated steel pipe wrapped in a layer of filter cloth leads to a gravity drain line of 200 mm diameter Series 100 polyethylene pipe. A Chemelex heat trace cable (12 watts/m) in a 19 mm Series 160 polyethylene raceway is inserted inside the larger pipe. A 1,220 mm (48") diameter manhole along the drain line is made of corrugated steel pipe.

2. The reservoir sides and bottom are covered with a 0.91 mm reinforced Hypalon and polyester liner over a 100 mm thick bedding of sand. Above the liner on the inside berm slopes (slope 1:3) 300 mm of gravel covers 150 mm of sand. The liner membrane itself is composed of 2 thicknesses of Hypalon synthetic rubber laminated to one layer of polyester reinforced fabric.

Garbage trench at dump

B.2.4 Reservoir Pumphouse and Truck Fill Point

The insulated pumphouse at the reservoir contains chlorination equipment and an electric heater. There is room for the later addition of fluoridation and filtration facilities if required.

B.2.5 Treatment

Only chlorination of the water is required. The hypochlorination equipment consists of a Wallace and Tiernan Model 745 hypochlorinator.

B.3 Water Distribution

Until the early 1970's, only the government and commercial buildings had water tanks. The native residents filled buckets from 4 strategically located 4,500 litre (1,000 Igal) tanks. By 1973 all residences were equipped with 1,136 litre (250 Igal) fibreglass tanks.

The water is transferred to tanks on trucks by means of an overhead truck fill system designed for two trucks filling back to back.

The average total daily consumption in 1978 was 4,550 litres. The contractor for the service is Arctic Circle Enterprises.

B.4 Sewage Collection

Arctic Circle Enterprises has the contract for sewage pumpout for twice weekly service. Bagged sewage is picked up 2 or 3 times a week. The latter type of sewage is collected in two 205 litre (45 Igal) drums by truck.

B.5 Sewage & Solid Waste Disposal

Dry garbage is picked up weekly and trucked to a 240 m by 300 m waste disposal area located on a flat gravel esker 1.6 km by road north of the community. Gravel layers up to 12 m thick in this area make it an ideal location for a disposal site.

Three trenches separately hold trucked liquid sewage, bagged sewage and dry garbage. The waste materials in the trenches are backfilled on a regular basis. The system, although simple, is operated and maintained well.

Water reservoir

B.6 Roads and Drainage

Roads within the settlement are gravel surfaced. Drainage is not generally a problem due to relatively permeable subsurface conditions and gentle grades towards the Mackenzie River.

B.7 Fire Protection

The fire protection facilities in Fort Good Hope consist of the following:

- there is a call box for every 74 people connected to an annunciator panel; it is a multi-zone system with an office/fire hall.
- the community has one 1969 triple combination pumper on wheels - there are approximately 10 volunteer firemen.

B.8 Other Services

Other services in Fort Good Hope include:

- winter road connecting to the Mackenzie Highway system
- 3 flights weekly from Inuvik
- mail service 3 times weekly
- freight by barge from Hay River
- power supplied by NCPC (750 KW)

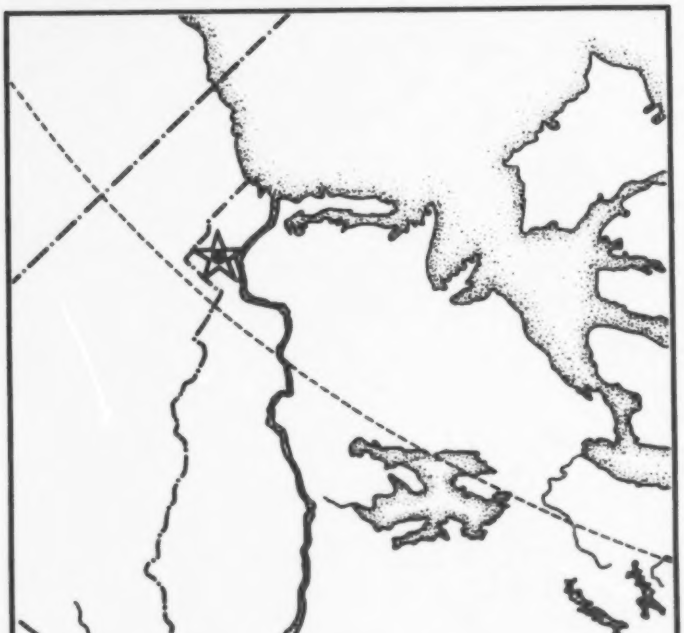
INFORMATION SOURCES

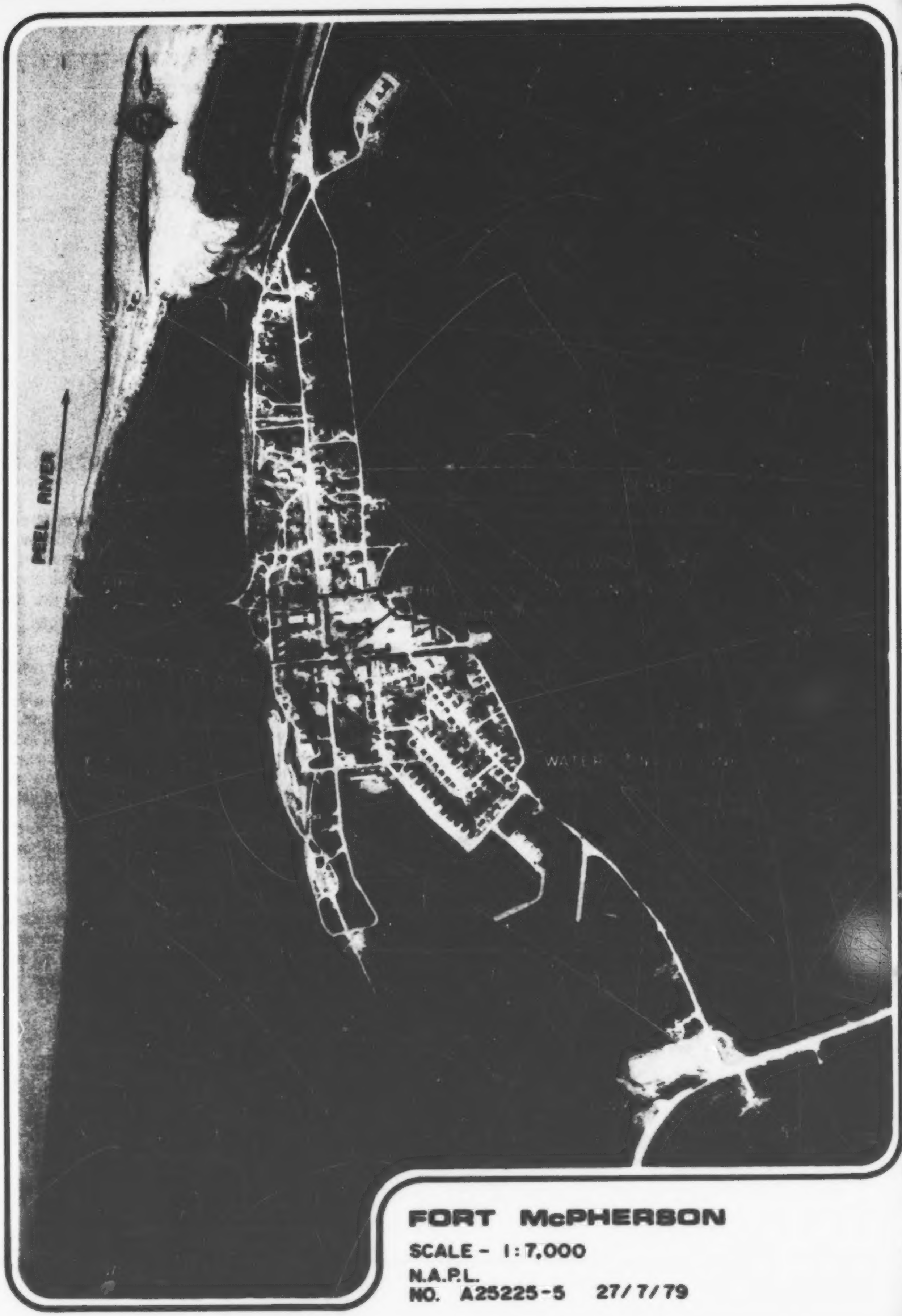
1. Associated Engineering Services Ltd., *Fort Good Hope Water Supply,* September, 1973.

2. Associated Engineering Services Ltd., *Engineering Report to G.N.W.T. on Fort Good Hope, N.W.T.,* 1970.

3. Thurber Consultants Ltd., *Fort Good Hope Water Supply Contract Documents,* March, 1979.

Fort McPherson




PEEL RIVER
N
WATER

FORT McPHERSON

SCALE - 1:7,000

N.A.P.L.
NO. A25225-5 27/7/79

Pumphouse at Water Lake

A. GENERAL

A.1 Location

Fort McPherson is located on a high point of land on the east bank of the Peel River about 38 km upstream from its confluence with the Mackenzie. The fairly level hill on which the settlement is located is about 1.9 km long by 0.8 km wide and is 15 to 21 m above the summer level of the Peel Channel. The townsite, at 67°27'N latitude and 134°53'W longitude, is 97 km south of Aklavik, and 1107 air km northwest of Yellowknife.

A.2 History

The Hudson's Bay Company established a post at the present location in 1840. Before that, the Loucheux Indians traded at Fort Good Hope. The fort was named after Murdoch McPherson, chief trader for the Hudson's Bay Co. In 1852, a Loucheux Indian village moved there for strategic reasons because of their conflicts with the Inuit. An Anglican Mission was set up there in 1860.

A.3 Community Information

Fort McPherson has settlement status. The population, predominately Loucheux Indian, numbered as follows over the past three years:

POPULATION	YEAR
813	1978
781	1979
793	1980

Due to the proximity of the settlement to the Dempster Highway, the economy will likely improve. A gas station/garage, tourist facilities and road maintenance are expected to provide jobs for the local inhabitants. Currently, some income is derived from trapping, manufacture of canvas products and handicrafts, and a few government jobs.

Services include a school, a curling rink, a nursing station. The settlement also has an Anglican Church and a visiting Roman Catholic priest. Freight is barged from Hay River in the summer months. A gravel surfaced runway, 1066 m by 30 m is located 3 km south of the settlement. The airstrip is at elevation 43 m ASL. A scheduled air service operates between Fort McPherson and Inuvik.

A.4 Geology and Terrain

The townsite, on a triangular bluff, is separate from the higher ground inland by valleys to the east and south. During severe flooding, these valleys become inundated and the community is surrounded by water. There are about 80 ha (200 acres) of developable land in the area. The area is in the continuous permafrost zone with some massive ice lensing. Permafrost can be found at depths of 0.3 - 1.2 m.

The upper soil strata is composed of organics and ranges from 0-3.5 m thick. Underneath is a layer of silt and grey clay classified as low to medium plastic which is found at a thickness of 1.2 to 3.7 m. The whole area is underlain by a cretaceous shale bedrock of which the upper 0.3 to 1.5 m is fractured and weathered.

A good source of durable shale and sandstone for fill is located 6.4 km northeast of the settlement. Gravel and sand for concrete and asphalt is found on a glaciofluvial outwash plain 44 km east of the settlement along the Dempster Highway. This source is the only major granular material between Fort McPherson and Arctic Red River and has an estimated 1.9 x 10^6 m^3 of material.

A.5 Vegetation

The region south of the settlement has birch and conifers up to 9 m in height. The low lying areas have alder and willows, while the better drained land has stands of black spruce and birch.

A.6 Climate

Fort McPherson experiences an average of 257 days with frost per year. The mean daily temperature in January is -29°C. July, the warmest month, has a mean daily temperature of 15°C. About 115 mm of rain falls each year. The mean annual snowfall is 222 cm. Prevailing winds are NNW at 3.5 - 4.3 knots.

B. MUNICIPAL SERVICES

B.1 Water Supply

Fort McPherson's water supply for 20 years has been Water Lake about 1.8 km south of the townsite (see aerial photo). It is piped through a supply line to a water treatment plant located in a wing of the abandoned hostel by the school. There it is treated for turbidity and chlorinated and stored in a 4500 L (1000 Igal) storage tank. Some buildings are serviced by piped water but the majority use trucked water.

B.1.1 Source

Water Lake drains into a southwardly flowing stream which eventually empties into Peel Channel (see aerial photo). The normal summer elevation is 13.25 m and the surface area of the lake when full is 9.3 ha (22.9 acres). The maximum depth is 8 m. The live storage (above the intake elevation) is 180,250 m^3 in summer. In winter, with 1.5 m of ice, the live storage is 51,950 m^3 and with 1.0 m of ice the water available is 91,100 m^3.

Each spring the Peel Channel backs up due to ice jams downstream at the junction of the Mackenzie River. The resulting rising water level enables Water Lake to be refilled from Peel Channel via the small connecting stream.

Water supply line

Chemical analysis carried out on the water supply water indicates that although the concentrations of total iron and the colour values are high, all other ion concentrations are within the acceptable limits of the Canadian Drinking Water Standard.

Following are some chemical analysis results from samples collected by the Water Resources Division, DIAND, Yellowknife. (All values in mg/L unless otherwise noted)

Parameter	**June 6, 1979**	**July 22, 1977**
pH	7.1	7.7
Sp. Cond.	389.9	216 umho/cm
Turbidity	1.75	2.5 JTU
Colour	60	50 units
Hardness (as $CaCO_3$)	125	98
Chloride (Cl)	18	0.6
Sulphate	21	
Iron	0.28	

B.1.2 Intake Facilities

The intake structure was reconstructed in 1975 and is in good condition. It consists of a moored floating wooden and corrugated steel platform with a suction line. A hinged utilidor connecting the platform to the pumphouse allows for variation in the water level. In summer, the intake elevation is about 11 m above the Peel Channel.

Currently, there are 2 Peerless horizontal centrifugal pumps (Model No. TBS-2x2x105) each with a capacity of 1.1 L/s. They were installed in 1960.

The 1680 m (5500 ft.) utilidor carrying the raw water to the treatment plant is an insulated wooden box utilidor on mud sills. It contains a 75 mm supply line and a 50 mm return line. Insulation in the utilidor consists of 100 mm of expanded polystyrene. The 20 year old utilidor itself is in fairly good shape but the supports need repair. Melting of permafrost has caused some trestles supporting the utilidor to be swept away leaving it precariously supported in several places. The embankment under the utilidor has been washed out in some areas.

To prevent the raw water from freezing, water heated in the treatment building is sent through the recirculation line and mixed with the cold water at the intake.

B.1.3 Treatment Facilities

Since turbidity and colour are high at break-up, a treatment plant to provide treatment with filtration and coagulation was deemed necessary. In 1977, a small Cochrane unit was replaced by a Neptune Micro-Floc Waterboy treatment plant in a new addition to the hostel's services wing. The new unit has a capacity of 5.6 L/s. It includes a backwash pump, an effluent pump and three chemical feeders (for alum, soda ash and calcium hypochlorite).

Backwash water is drawn from an insulated storage tank for treated water. The backwash water eventually drains into a 143 m long insulated backwash sewer 250 mm in diameter.

B.1.4 Pumping Facilities

The pumps are approximately 20 years old. The specifications of the two circulating and fire pumps are as follows:

1. Function: Circulation pump
   Type: Peerless Vertical Turbine
   Capacity: 3.5 L/s at 413.7 kPa TDH (46 Igpm @ 139' TDH)
   Motor: Electric
2. Function: Circulation Pump
   Type: Peerless Vertical Turbine with L-head drive
   Capacity: 3.5 L/s @ 180 kPa TDH (46 Igpm @ 60' lead TDH)
   Motor: Dual Driven - electric or gasoline engine.
3. Function: Fire Pump
   Type: Peerless Vertical Turbine pump with L-head drive
   Capacity: 25 L/s @ 687 kPa TDH (330 Igpm @ 230' TDH)
   Motor: Lister Diesel Engine

B.1.5 Storage Facilities

The main storage tank is located beside the water treatment plant. The lined, insulated wood stove tank was erected in 1975. Its capacity is 455,000 L (100,000 Ig).

The services wing contains a 20 year old 77,300 L (17,000 Igal) rectangular steel tank. This clearwell, with a wall thickness of 2.9 mm, is used as a pumpwell for the two distribution pumps and a fire pump.

B.2 Water Distribution

Water in Fort McPherson is both piped and trucked. In the winter, steam coils are used to heat the water in the clearwell before it is pumped to the 3 distribution loops. Excess water is returned to the storage tank.

B.2.1 Piped System

The circulating pipes (100 mm supply and 50 mm return) which serve more than 150 people, are housed with a sewer pipe in a plywood insulated utilidor approximately 3050 m long. Presently it is in need of repair. About 150 m of additional utilidor was added to service a nursing station and some staff houses. This section is diamond shaped and made of riveted tin. The utilidor will probably be used as long as practical and then all water will be trucked.

B.2.2 Trucked Water

A truck fill arm extends from the hostel services wing. The water is distributed via a 1976 Ford F600 vehicle with an insulated 4.5 m³ (1000 Igal) tank.

In 1980-81, approximately 172,500 L (38,000 Ig) of water per month was delivered to households in the settlement. The contractor, in the past year has been F. Blake Sr.

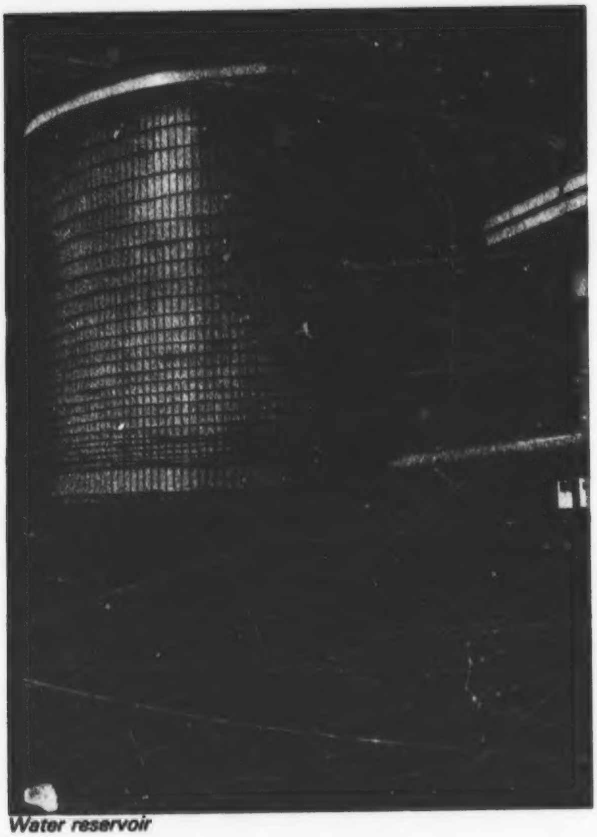
B.3 Sewage Collection

Sewage pumpout from holding tanks, bagged sewage and gravity sewer in the utilidor are the methods of sewage collection in the settlement.

About 16 residences have holding tanks which are pumped out every weekday under local contracting (F. Blake Sr.) using a 1979 Ford F600 tank truck.

Bagged sewage is collected daily with a 3/4 ton crew cab using 45 gal barrels.

The gravity sewers consist of 100 mm, 150 mm and 200 mm asbestos cement pipe in a utilidor system. They discharge through an outfall into Sewage Lake (see aerial photo). Only buildings with access to the utilidor are connected to the gravity sewer system.



Water reservoir

B.4 Sewage Disposal

B.4.1 Bagged Sewage and Sewage Pumpout Disposal

The disposal area is located 8 km from the settlement along the Dempster Highway.

It consists of an old shale borrow pit with steep benches and sideslopes, with ample quantities of material for cover. Garbage and honeybags are compacted and covered once or twice a month. Trucked sewage is emptied into a pond at that site which eventually drains into the Peel Channel downstream from the community. F.A. Blake had the contract for bagged sewage pick-up in 1980-81. The Fort McPherson Settlement Council had the contract for sewage pumpout for the same year.

B.4.2 Piped Sewage Disposal

The sewage outfall discharges into a lake east of the settlement and just north of Water Lake. Sewage Lake has a surface area of approximately 101 ha (250 acres) and an averge depth of 1.5 m. A small creek leads from this lake to the Peel Channel at a point 2.4 km downstream from the townsite.

Sewage Lake is separated from Water Lake by the Dempster Highway. Although there was concern in the past regarding contamination of the water supply in the flood season, the new highway embankment has reduced the likelihood of that happening. The soils in the embankment are relatively impermeable and therefore seepage should not occur.

The sewage outfall has been damaged by flooding and ice movement. The last 54 m of the outfall utilidor consists of 200 mm pipe insulated with 100 mm of expanded polystyrene insulation inside a corrugated pipe. Concrete blocks have been attached to stablize the outfall.

B.5 Solid Waste

Solid wastes are collected from barrels in front of residences. Usually the garbage is burned before pick-up.

A one ton flat deck truck is used for garbage pick-up every second day. The solid wastes are disposed in the aforementioned shale pit. The garbage disposal contract for 1980-81 was held by R. Alexie.

B.6 Roads

The roads in Fort McPherson were built with silt and shale fill. The crushed surface shale breaks down upon exposure and becomes greasy when wet. Road improvements are planned now that a good source of gravel is available.

B.7 Drainage

Drainage is not a problem in areas with a natural slope. The newly developed sections situated on low ground experience some problems with removal of surface run-off. Extensive drainage improvement work is planned for the years following.

B.8 Fire Protection

Call boxes are connected to an annunciator panel in the fire hall. There is one call box for every 63 people. The fire truck type is a 1966 standard wheeled triple combination pumper. Approximately 14 men are signed up as volunteer firemen.

The utilidor system includes a Peerless Vertical Turbine pump rated at 25 L/s @ 687 kPa (330 Igpm @ 230' TDH) driven by a Lister Diesel engine for fire protection.

B.9 Other Services

Other services include telephone, television, and mail service 3 times weekly. NCPC provides power to the community with diesel generation facilities.

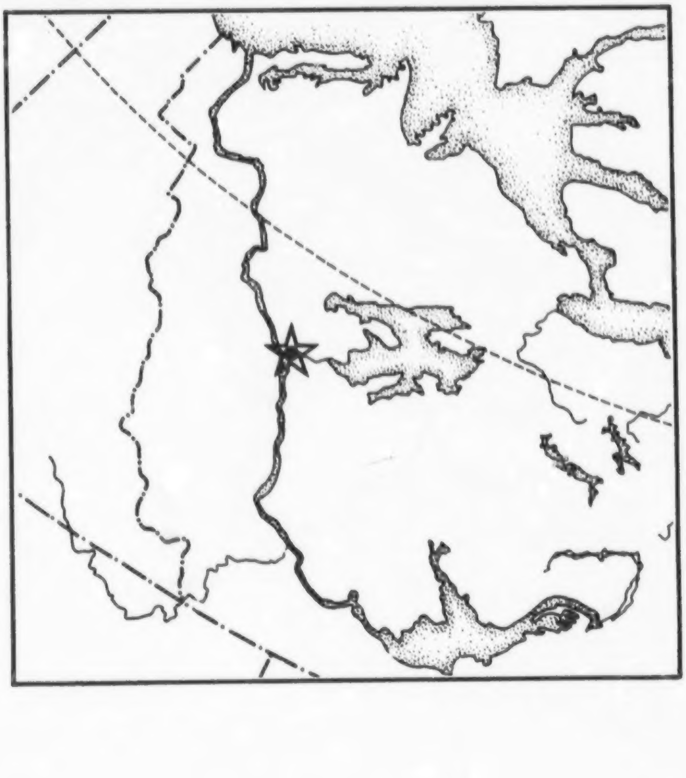
INFORMATION SOURCES

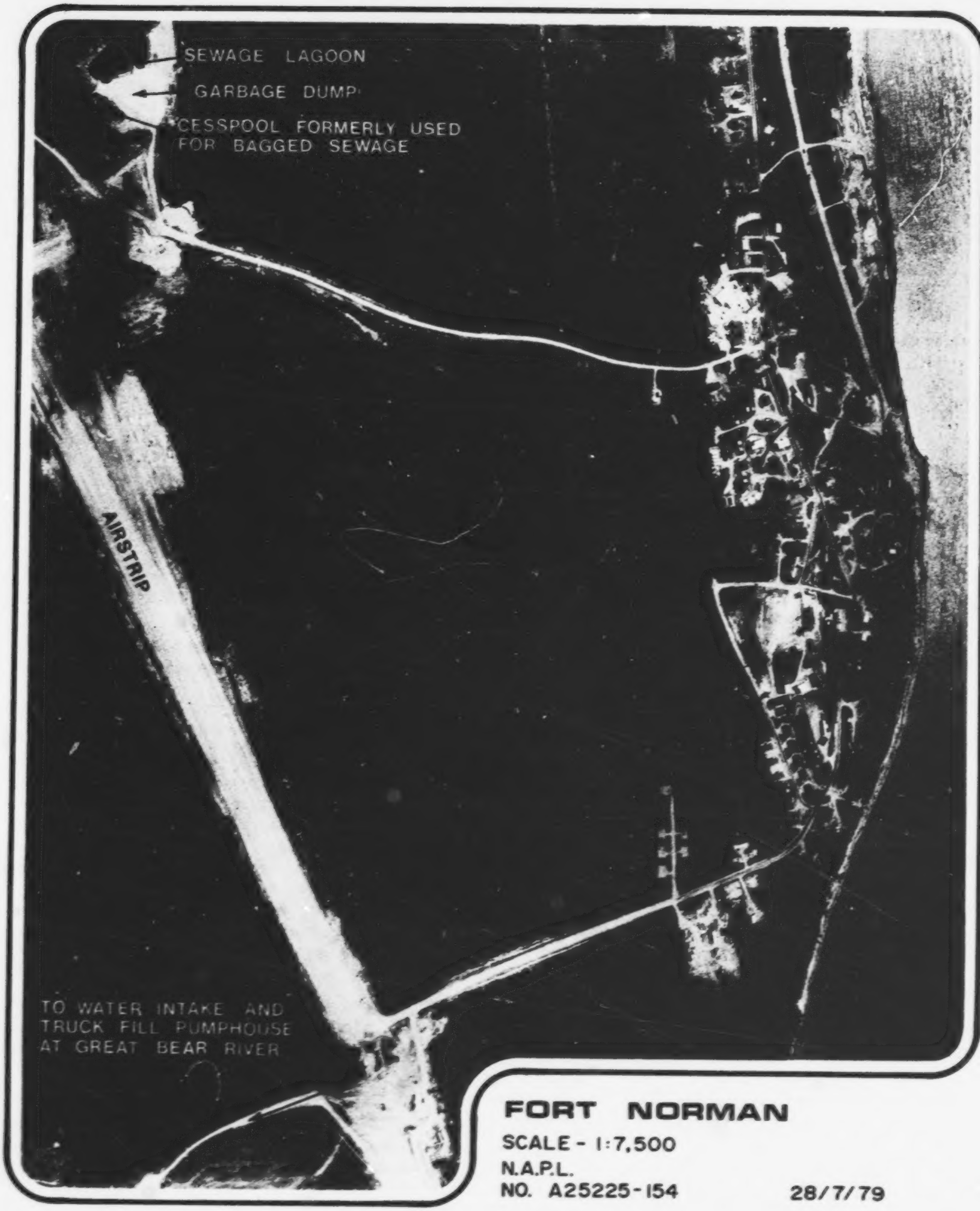
1. Associated Engineering Services Ltd., *Mackenzie Delta Regional Planning, Draft Growth Projections for Municipalities,* March, 1976.

2. Associated Engineering Services Ltd., *Fort McPherson Water and Sanitation Study -Draft,* January, 1980.

3. Associated Engineering Services Ltd., *Field Survey and Subsoil Inves tigation of Fort McPherson, N.W.T.,* June, 1978.

Fort Norman




SEWAGE LAGOON
GARBAGE DUMP
CESSPOOL FORMERLY USED FOR BAGGED SEWAGE
AIRSTRIP
TO WATER INTAKE AND TRUCK FILL PUMPHOUSE AT GREAT BEAR RIVER

FORT NORMAN

SCALE - 1:7,500
N.A.P.L.
NO. A25225-154 28/7/79

Plane and Taylor Lakes — Fort Norman on left

A. GENERAL

A.1 Location

Fort Norman is located at the confluence of the Great Bear and Mackenzie Rivers, on the east bank of the former and the north side of the latter. The settlement is 523 km by air southeast of Inuvik, and 624 km by air northwest of Yellowknife. Its coordinates are 64°54'N latitude, 125°34'W longitude.

A.2 History

The Northwest Company established a trading post at the junction of the two rivers in 1810. The site of the fort was changed several times but the community now occupies the original location which the Indians named Tulita or 'where the two rivers meet'.

Fort Norman

Fort Norman has always been a transportation junction for water traffic between the Mackenzie River and Great Bear Lake, and was an important transfer point when pitchblende was discovered on Great Bear Lake in 1931.

A.3 Community Information

Fort Norman achieved settlement status in 1971. The residents are 95% Slavey and Hare Indians and Metis. The population has increased by roughly 50 people in 10 years.

POPULATION	YEAR
329	1978
312	1977
359	1980

The economy is still based on hunting and trapping, though some men have been employed by local construction projects such as the new airport.

The settlement has a community center, a nursing station, new primary school with a large gymnasium, a baseball diamond, and a hotel. The sand airstrip just north of Fort Norman is 914 m by 30 m at an elevation of 97.5 m ASL and is undergoing expansion. Freight, mail and passengers are carried on the 2 weekly flights from Norman Wells. The telephone service is CNT radio.

A.4 Geology and Terrain

The buildings were erected on two terraces rising from the stable river banks - one 11 m above the river, the other 23 m above the river. From the top of the bank inland for about 250 m the ground slopes up. Beyond that point is low ground and muskeg. The airstrip is located on a low ridge behind the wide flat area.

Permafrost is found to a depth of 50 m. The active layer is 0.6 m to 1.5 m thick. Fort Norman is in the discontinuous permafrost zone. Considerable degradation occurs upon removal of the vegetation cover which is less than half a metre thick. The soil profile consists of layers of clay, silt, sand and some gravel in isolated pockets. Ice contents are high in the surface soils.

A.5 Vegetation

There are stands of black spruce interspersed with birch, white spruce and alder. Trees taller than 9 m are only found by ponds and streams. Beyond the poorly drained low-lying area (muskeg) the area is heavily treed.

A.6 Climate

Fort Norman experiences an average of 246 days of frost per year. Of the mean annual precipitation, 198 mm falls as rain and 1354 mm falls as snow. The mean daily temperature in January is -28°C and the mean daily temperature in July is 16°C. The prevailing winds are southeasterly.

Dual intake piping in pumphouse

B. MUNICIPAL SERVICES

B.1 Water Supply

Until new intake facilities were built in 1976, water was pumped directly from the rivers into a water truck. Great Bear River has good quality water for year-round use but Mackenzie River water was pumped during the winter because of the poor condition of the Great Bear access road in inclement weather. A steel storage tank was erected at the end of the airstrip.

A well drilled in July, 1970, produced 4.5 L/min but the water quality deteriorated over the winter and use was discontinued.

The new facilities include a pumphouse and intake on the bank of Great Bear River for the single water supply. Water continues to be trucked from the pumphouse in a 5455 L (1200 Igal) tank truck.

B.1.1 Source

Water from the Great Bear River is good year-round. Turbidity levels increase in the spring when the Mackenzie River backs up, but so far no treatment aside from chlorination has been found necessary. Below are some representative water sample data: (All values in mg/L unless otherwise indicated)

Constituents	**Great Bear River**	**Mackenzie River**
ph	8.2	8.1
Hardness (as $CaCO_3$)	70	110
Total Alkalinity (as $CaCO_3$)	51	80
Total Iron (Fe)	0.4	0.24
Color (units)	10	40
Turbidity (units)	4	35
Calcium (Ca)	16	32
Magnesium (Mg)	7	7
Bicarbonate (as CO_3)	31	49
Total Dissolved Solids	120	176

(Great Bear River Sample July 7, 1972 and Mackenzie River Sample July 10, 1972 taken by W.J. Francl & Associates).

B.1.2 Intake Facilities

The pumphouse and intake into Great Bear River are located 0.8 km from the confluence of the two rivers and about 1.5 km from the community.

Two 250 mm diameter buried intake shafts descend from the pumphouse which is located 12 m above low water level.

The 52 m long shafts terminate 12 m out from an old dock along the shore, 0.3 m above the river bottom. The Schedule 80 Dupont Sclairpipe shafts are 5 m apart under water.

Water intake/pumphouse

The lower end of the polyethylene pipe is inserted in a 15 m long 460 mm diameter galvanized corrugated metal culvert pipe which is anchored by lengths of used crawler tractor tracks and a gravel cover.

The end of the shafts have 0.3 m lengths of stainless steel Johnson 0.50 mm slot well screen bolted on.

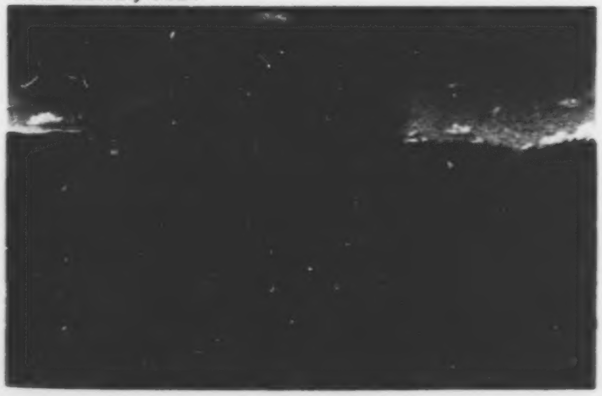
Each shaft contains a submersible pump near the screened inlet as well as a 75 mm insulated and heat traced supply line. This pipe is Schedule 80 HDPE Sclaircor pipe traced with 26 watts/m in a 19 mm black conduit. There is a conduit for a temperature sensor, and a 50 mm backwash line. Everything is encased in a yellow jacket. Either pump may be used to backwash the other supply line. When the pumps shut down, the lines drain to the river.

A winch and cable arrangement is provided to withdraw the pump and supply line. The winch is a Bulldog Junior Model one ton hoist with a drum capacity of 152 m of 6 mm cable.

B.1.3 Treatment

The water is chlorinated during pump operation when filling the water delivery truck. The chlorinator, located in the 4.6 m square pumphouse is a Precision Control Products Model 8311-11 hypochlorinator which is calibrated for only one pump running. Metered water is sent through an overhead truck fill arm. No storage is provided in the system.

Water delivery truck



B.1.4 Pumping Facilities

Each of the two submersible pumps has the following characteristics:

Model:	Flygt Model B-2070 electric
Capacity:	5.7 L/s @ 269 kPa TDH (75 Igpm @ 90' TDH)
Motor:	3 phase, 60 Hz, 3600 RPM

B.2 Water Distribution

The 5455 L water truck delivers six full loads per day. The truck is equipped with a 3 HP Briggs and Stratton pump and a Neptune meter. Most houses have water tanks with a capacity of 1140 L or more. Yakeleya Brothers Contracting has the current water delivery contract.

B.3 Sewage Collection

Some sewage is retained in pit privies though most residences have pumpout tanks. Some tanks are underground. There are tanks large enough to act as septic tanks where only the liquid is removed. The newer low rental homes have 1360 L steel tanks under the floor. Other tanks have capacities up to 18,200 L (4000 Igal). Many homes are served by sewage bag system.

The wastes are pumped and hauled by the Yakeleya Brothers every week. The present policy of the GNWT is aimed at phasing out the honey bag and privy system and having all homes equipped with sewage holding tanks.

B.4 Sewage Disposal

Sewage pumpout has been dumped in a lagoon beside the airport. Expansion of airport facilities has required that a new lagoon be developed in the near future. Taylor Lake, 3 km northeast of the settlement, is being developed. It is about 5 ha in area, has an average depth of 3 m and drains into Mackenzie River upstream from the settlement via a small creek.

B.5 Solid Waste Collection and Disposal

Garbage is set out in oil drums in front of homes and is usually pre-burned before pick-up.

The solid waste dump is located at the east end of the airstrip near the sewage lagoon approximately 1.4 km from the community. The dump will also have to be relocated and alternate sites are being evaluated.

B.6 Roads

Roads in the community are generally unsurfaced and hence dusty. A winter road connects Fort Norman with Fort Franklin.

B.7 Surface Drainage

Drainage in the developed areas along the bank of the Mackenzie River is good due to the profile of the land. There is no constructed system of drainage ditches.

B.8 Fire Protection

Fire protection for the community of 312 is provided by about 10 volunteers with a 1966 standard wheeled triple combination pumper.

INFORMATION SOURCES

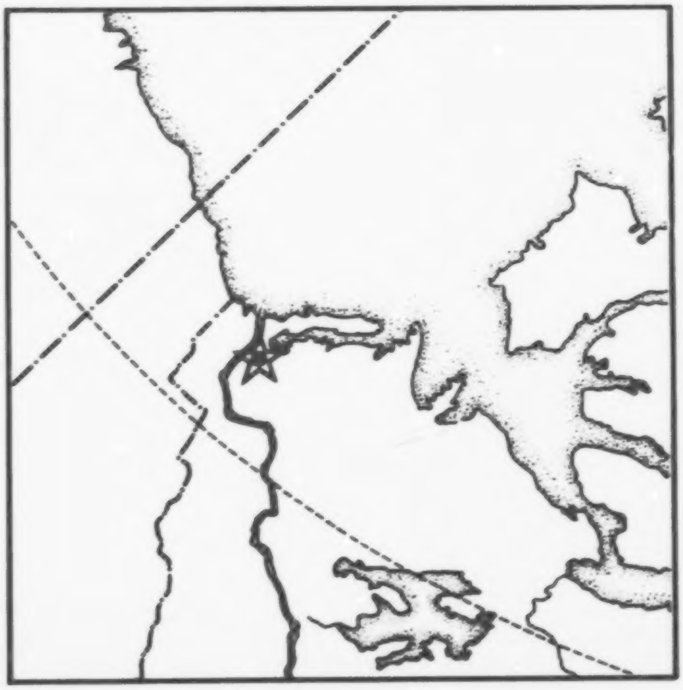
1. W.J. Francl & Associates Consulting Engineering Ltd., *Draft of Development Plan, Fort Norman, N.W.T.*, September, 1974.

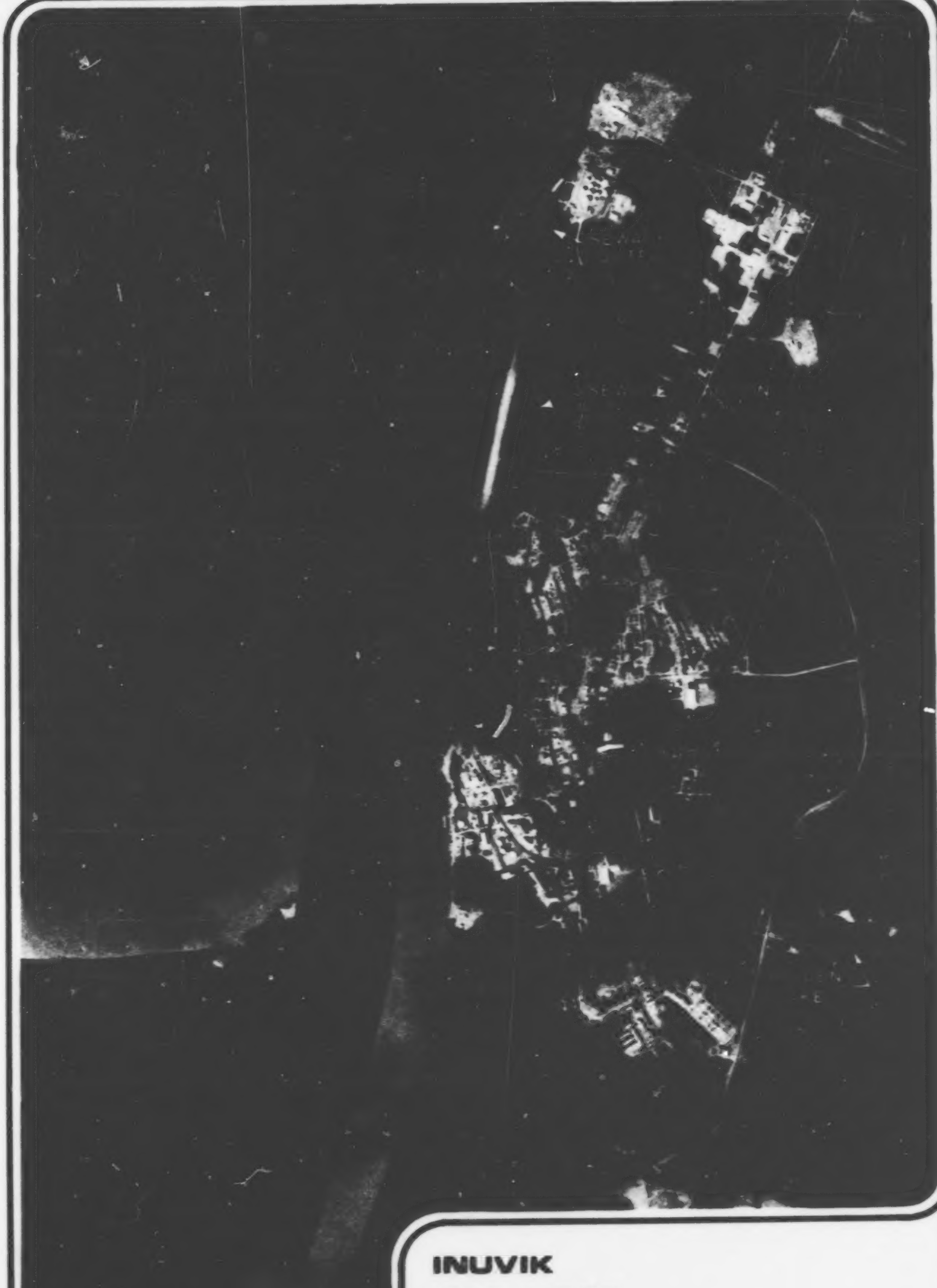
2. Department of Public Works, Government of the Northwest Territories, *Operations and Maintenance Manual, Fort Norman Water Supply,* 1977.

3. M.M. Dillon, Consulting Engineers and Planners, *Fort Norman, N.W.T., Sewage and Solid Waste Disposal Pre-design,* January, 1980.

4. W.J. Francl & Associates Ltd., *Report on a Water Supply Study for Fort Norman,* January, 1974.

Inuvik





INUVIK

SCALE - 1:20,000
N.A.P.L.
NO. A25224 - 109, 110 & 111 27/7/79

Aerial view

A. GENERAL

A.1 Location

Inuvik is located at 68°21'N and 133°43'W on the East Channel of the Mackenzie River. It is about 1,000 km by air northwest of Yellowknife on the eastern edge of the Mackenzie Delta. The Town is about 195 km north of the Arctic Circle and situated in the transitional area between the arctic forest and tundra.

A.2 History

Inuvik means 'place of man' in Inuktitut. The site of Inuvik was seldom visited until 1954 when the Federal Government decided to create a new administrative centre for the Mackenzie Delta to replace the existing settlement of Aklavik. The site was selected mainly because of the large, level area, well above flood levels, the presence of good gravel materials for construction, location on a navigable waterway and the opportunities for modern airport facilities. Construction of Inuvik lasted from 1955 to 1961.

Inuvik has grown from a government centre to become a communications and staging centre for oil and gas explorations activities in the region. It also provides major transportation, health, educational, and administrative services to the region.

A.3 Community Information

Inuvik has grown in the past twenty years from about 1,200 persons in 1961 to about 3,000 today. The population increased significantly in the mid-seventies along with major gas and oil exploration activities taking place early that period in the delta region. When the exploration activity declined somewhat in the late seventies, the population also declined as shown in the following estimate for the years 1976 to 1980.

POPULATION	YEAR
3,115	1976
3,127	1977
2,938	1978
2,892	1979
2,929	1980

The population is expected to grow gradually again, with the influence of increased petroleum exploration activities in the Beaufort Sea region and due to increased tourism, and natural growth.

The population consists of approximately 7% Dene, 17% Inuit, and 76% other.

The Town has an elementary and high school serving the region. The 1979 enrollment was 459 and 396 for each school respectively.

The Inuvik hospital, owned and operated by Health and Welfare Canada, has a capacity of 120 beds.

Many denominations have maintained places of worship in the community.

A 15 member detachment of the RCMP provides police services. The Department of National Defence presently employs 243 persons of all ranks in Inuvik.

Other government agencies operating out of the Town include the Department of Indian and Northern Affairs (Renewable and Non-Renewable Resources as well as the Inuvik Research Laboratory) and the Government of the Northwest Territories.

A controlled airport is located about 7 km east of the Town which has a 9,600 m x 240 m asphalt runway. PWA provides regular scheduled air service to the community. Other scheduled and charter aircraft companies operate from Inuvik. A small gravel surfaced runway located in the Town is used by small and private aircraft. Float planes use Shell Lake located about 2.5 km east of Town during the summer.

The Dempster Highway, officially opened in 1979 provides an important all weather road link to Inuvik.

A.4 Geology and Terrain

There are three major physiographic regions in the Inuvik area; the Mackenzie Delta, the Caribou Hills and the Anderson Plains. Inuvik itself is situated on a river terrace in the Delta Region. The land rises gently to the northeast and is characterized by fine-textured, sandy silty clay which is underlaid by a silt-clay with gravelly material. It is in a continuous permafrost region and ice lensing is common. The active layer varies in thickness from 45 to 75 cm.

The Anderson Plains region, to the east, is an area of gentle undulations, knolls, hummocky hills which was modified extensively by glaciation. Paleozoic rocks underlie Quaternary sediment deposits in this area and bedrock cover is generally thin.

The Caribou Uplands, north and west of Inuvik are composed of Quaternary sediments, generally thin, which cop gravels, sands and tills. Granular materials are quarried in this area for use by the Town.

A.5 Vegetation

In the Inuvik region, white spruce along with birch, alder and poplar are common on open slopes and hilltops where drainage is good. Black and white spruce occupy gentler slopes and lower areas. In low, poorly drained areas, lichens, sedges, cottongrass and sphagnum are found in association with black spruce.

A.6 Climate

The July mean high and low temperatures are 19.7°C and 8.2°C respectively. The January mean high and low temperatures are -26.1°C and -35.7°C respectively. The average temperature is -9.6°C. The total yearly precipitation averages 276.1 mm with 110 mm of this occurring as rainfall.

B. MUNICIPAL SERVICES

B.1 General

The level of servicing provided in Inuvik is relatively high for a northern community. Essentially, all of the development within the townsite is serviced with a piped water and sewer utilidor system.

During the winter months, potable water is pumped from the East Channel of the Mackenzie River using a portable intake system. During the summer, the supply is 'Lake B'. Water is pumped from this lake to Hidden Lake near Town which is used as a storage reservoir. Additional storage tanks are provided at this elevation which 'float' on the distribution system to maintain gravity pressure.

Water from the East Channel source is also pumped to the storage tanks after treatment prior to distribution during the winter. Inuvik presently has access to good supplies of water during winter and summer, however, during spring break-up and fall freeze-up, either facility can be used. The Town relies on water stored in Hidden Lake as a raw water storage reservoir during those periods.

Sewage is collected by a gravity sewer system discharging to a lagoon which ultimately discharges into the East Channel following retention.

NCPC owns and operates the water, sewer and district heating utilities as well as the power genera-

Mackenzie Delta west of Inuvik

Igloo Church

tion and distribution system. NCPC sells the utility services on a consumption basis.

B.2 Water Supply

B.2.1 Winter Source

The East Channel of the Mackenzie River as it passes by the townsite is about 215 m wide and during the winter reaches a maximum depth of approximately 3.5 m at mid-stream. During the period from December to mid-May when it is used as the potable water source, the chemical quality of the water is satisfactory for use. During this period normal levels of turbidity, colour and hardness are 5-15 JTU, 0-5 TCU, and 135 mg/l respectively. During the open water period, and in particular at spring break-up, river flows increase as well as turbidity and colour levels, making it unsuitable for direct use as a potable supply. Following are some typical water quality characteristics. (All values in mg/l unless otherwise noted)

Parameter	Value	
	Open Water	Ice Cover
pH	8.0	8.1
Hardness (as $CaCO_3$)	102	135
Alkalinity (as $CaCO_3$)	31.2	40.4
Calcium (Ca)	5.4	11.0
Sodium (Na)	80	100
Potassium (K)	0.9	1.2
Sulphate (SO_4)	23.2	35.0
Chloride (Cl)	5.9	13.0
Total Phosphorus (PO_4)	0.15	0.017
Total Nitrogen (N)	0.67	0.48
Turbidity	110	7.0 JTU
Colour	50	10.0 TCU
Total Organic Carbon (TOC)	10	6.0

(AESL - 1978)

B.2.2 Summer Source

Lake 'B' located about 4.8 km northeast of Inuvik, is used as the summer water source. It is one of the many small lakes occupying small valleys in the range of hills which form the Delta's eastern margin. It has a surface area of 176 ha (0.68 square miles) and a catchment area of about 1660 ha (6.4 square miles).

Its maximum depth at normal high water is about 9 m. It has been estimated by the Arctic Hydrology Section, Environment Canada, that the Lake 'B' watershed might be expected to produce 0.83 to 1.67 million m³ of water in an average year. Inuvik's total yearly water demand in 1977 was 0.8 million m³ for the purposes of comparison. It is expected that Lake 'B' will be adequate for Inuvik's summer requirements for some years to come. Lake 'B' provides a naturally clean soft water having little colour.

B.2.3 Intake and Treatment Facilities

Winter Operation

During winter, water is pumped from the East Channel using a portable intake pumphouse situated on the ice and pumps to the newly constructed water treatment plant situated immediately north of Duck Lake (see figure). The intake facility is a Flygt submersible pump having a capacity of 20 L/s @ 18.3 m TDH (267 igpm @ 60 ft. TDH).

The water is pumped from the plant through 1,585 m of 100 mm diameter pipe in a utilidor raw water line directy to Hidden Lake. Alternatively, the water is heated, filtered, chlorinated and fluoridated and pumped directly into the distribution system. The raw water pipeline system includes a booster station at the bottom of Hidden Lake Hill capable of supplying 20 L/s @ 72 m TDH (267 igpm @ 235 ft. TDH).

The new water treatment plant (filter/booster pump stage) has a capacity of 5,230 m³/day (1.15 million imperial gallons per day) and is reported to be adequate to serve the requirements of Inuvik's population to 8,000. The plant includes water preheating facilities, gravity filters, chlorination and fluoridation equipment, chlorine contact tank and distribution pumps, metering, controls, alarms, connections to the existing booster stations and to the water distribution system as well as a backwash discharge line.

Summer Operation

During the summer, Lake 'B' water is discharged into Hidden Lake and is then pumped through a

Intake pumphouse at Hidden Lake

Winter intake in east channel

microstrainer plant. It is chlorinated and fluoridated prior to entering the distribution system.

The intake at Lake 'B' extends from the intake pumphouse 39 m into the lake and is supported on piles. A catwalk in the pile line permits access to the intake for maintenance.

The screened intake is situated in about 1.2 m of water and can be raised out of the water prior to winter each year. The intake pumphouse, approximately 3 m x 4.3 m contains a single pump with the following specifications:

Make and Model: Peerles Model 4AD18.5-6x4
Series 5200 single stage double suction
Motor : 75 HP, 1800 RPM

The pipeline to Hidden Lake is about 4.9 km long and consists of 200 mm diameter pipe for the first 3.4 km and 150 mm diameter for the remaining section. The pipe is uninsulated welded steel pipe laid directly onto the ground. Every 122 m a right angle offset of 2.1 m is provided for expansion and contraction. The pipeline delivers in the order of 3,600 m³ per day to Hidden Lake during the summer.

The intake pumphouse at Hidden Lake contains four pumps:

- (1) 10 HP electric motor driven distribution pump
- (2) 40 HP electric motor driven fire pumps
- (1) gasoline engine driven fire pump

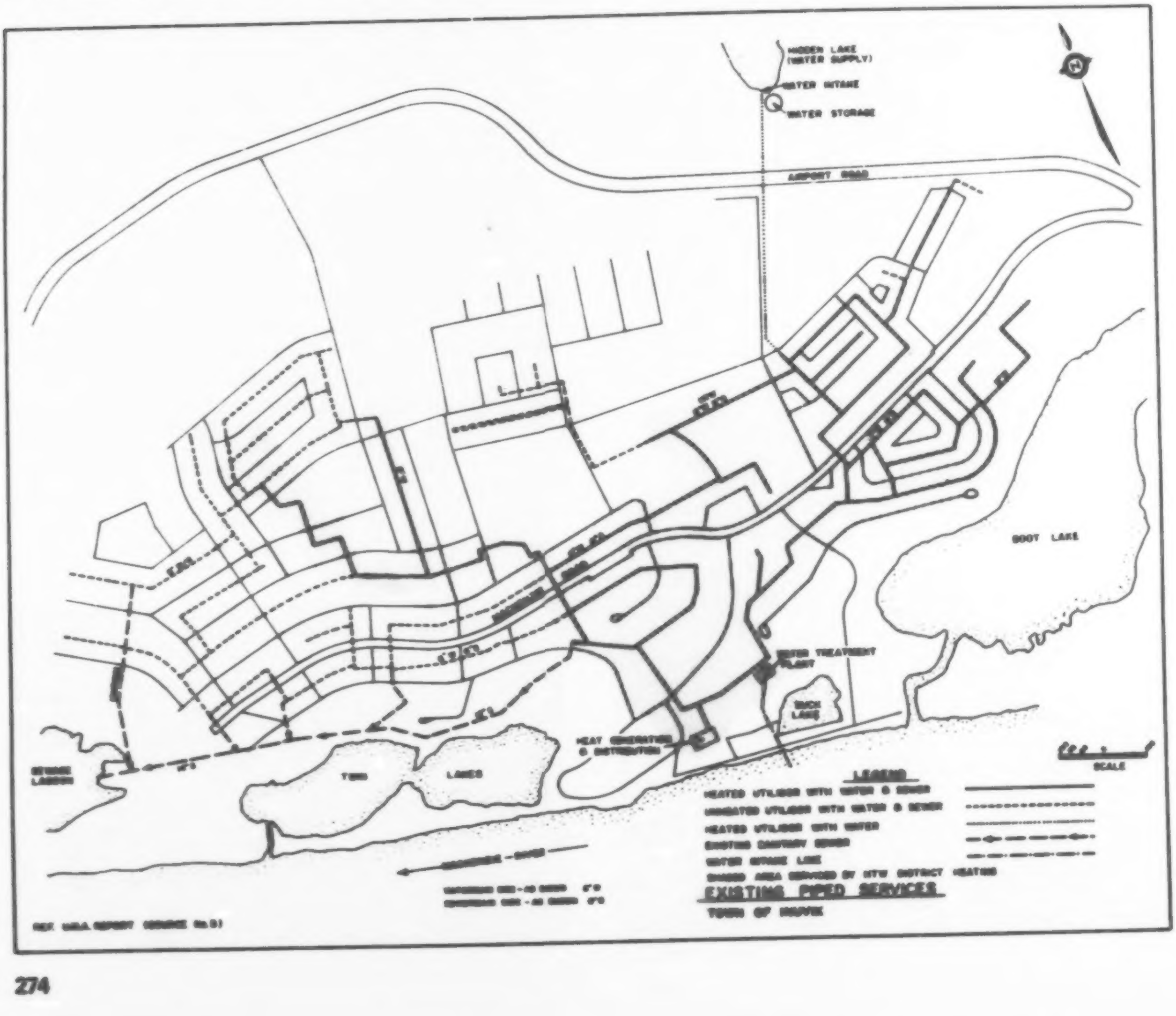
The microstrainer plant located at the high point between Hidden Lake and Inuvik has a capacity of 11.4 L/s (150 igpm) and has an automatic bypass which permits any excess demands to be met.

Water from the microstrainer is chlorinated and fluoridated prior to entering a 409 m³ (90,000 igal) storage tank in the microstrainer building and a recently added 2,275 m³ (500,000 igal) storage tank located at the high point of the system near Hidden Lake. These tanks 'float' on the distribution system and provide for peak consumption and fire flow demands.

B.2.4 Distribution System

B.2.4.1 Piped System

The distribution system consists mostly of asbestos-cement pipe ranging in size from 100 mm to 300 mm in diameter within the utilidor system (see figure


HIDDEN LAKE
(WATER SUPPLY)
WATER INTAKE
WATER STORAGE
AIRPORT ROAD
BOOT LAKE
WATER TREATMENT PLANT
DICK LAKE
HEAT GENERATION & DISTRIBUTION
SEWAGE LAGOON
TWIN LAKES
MACKENZIE RIVER
SCALE
LEGEND
HEATED UTILIDOR WITH WATER & SEWER
UNHEATED UTILIDOR WITH WATER & SEWER
HEATED UTILIDOR WITH WATER
EXISTING SANITARY SEWER
WATER INTAKE LINE
SHADED AREA SERVICED BY NTPC DISTRICT HEATING

EXISTING PIPED SERVICES
TOWN OF INUVIK

showing existing piped services). The consumption rate for the Town is approximately 705 lpcd (155Igpcd) at present.

Since Inuvik was established in 1956, numerous utilidor designs have been used. Experimentation has occurred mainly due to the high capital cost of utilidor construction (see figure showing cross-sections of utilidors). A major portion of the utilidor system carries piping of Inuvik's central heating system. Utilidors which carry high temperature water (HTW) lines, are heated by loss from these lines. The HTW steel lines vary from 32 to 200 mm in size. The supply water temperature is about 193°C (380°F) and returns at approximately 121°C (250°F). Heat is provided by NCPC's 900,000 BTU/hr. Bunker C fired boiler during winter and 300,000 BTU/hr. boiler maintains heat during the summer for the various types of customer heating loads on the system (including buildings). The remaining utilidors are designed to be kept from freezing by insulation, heat added directly to the water at selected locations and by circulation. Circulation flows in all unheated utilidors are generally above 0.03 m/sec throughout the normal range of demand levels.

B.2.4.2 Trucked Services

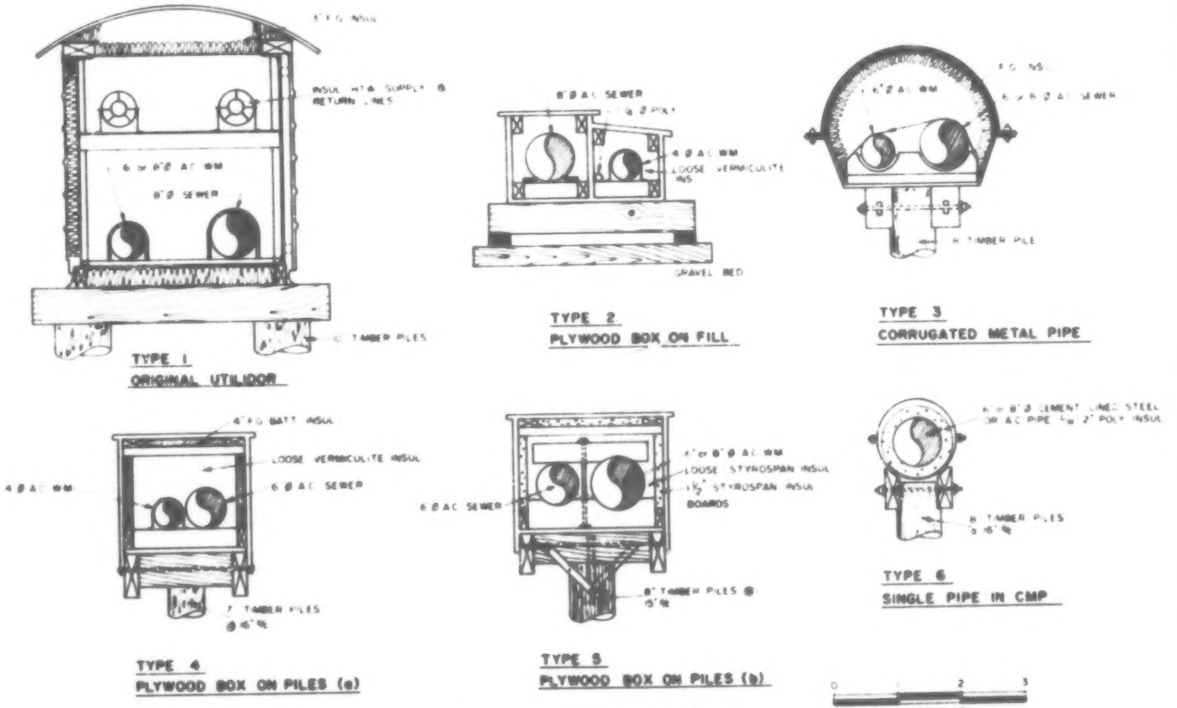
At present (1981), there are about 22 housing units which still require trucked service. These units are mainly small sub-standard houses located in the west end. The service is operated by the Town which provides delivery three times per week. The cost to consumers is government subsidized.

Utilidors

B.3 Sewage Collection

The gravity sewage collection system consists mainly of asbestos cement pipes ranging in sizes from 100 to 350 mm in diameter. An insulated 200 mm diameter above ground outfall line discharges to a sewage lagoon located beside the East Channel, west of the Town.

As mentioned earlier, about 22 homes are on a trucked system. The Town provides a bagged sewage pick-up service for these units.


3" F.G. INSUL
INSUL HTW SUPPLY & RETURN LINES
6 or 8"Ø AC WM
8"Ø SEWER
10" TIMBER PILES
TYPE 1
ORIGINAL UTILIDOR
8"Ø AC SEWER
1¼ Ø POLY
4 Ø AC WM
LOOSE VERMICULITE INS
GRAVEL BED
TYPE 2
PLYWOOD BOX ON FILL
F.G. INSUL
6"Ø AC WM
6 or 8 Ø AC SEWER
8" TIMBER PILE
TYPE 3
CORRUGATED METAL PIPE
4" F.G. BATT INSUL
LOOSE VERMICULITE INSUL
4 Ø AC WM
6 Ø AC SEWER
7" TIMBER PILES @ 16' %
TYPE 4
PLYWOOD BOX ON PILES (a)
4" or 8" Ø AC WM
LOOSE STYROSPAN INSUL
1½" STYROSPAN INSUL BOARDS
6 Ø AC SEWER
8" TIMBER PILES @ 15' %
TYPE 5
PLYWOOD BOX ON PILES (b)
6 or 8" Ø CEMENT LINED STEEL OR AC PIPE c/w 2" POLY INSUL
8" TIMBER PILES @ 16' %
TYPE 6
SINGLE PIPE IN CMP
0
1
2
3
SCALE IN FEET
TOWN OF INUVIK - UTILIDOR TYPES

B.4 Sewage Treatment

Since 1957, Inuvik's domestic sewage has been discharged to a lagoon located west of the townsite as shown in the aerial photo. The lagoon is about 20 ha in size and was formed by constructing berms along three sides of a low lying area. It has an average depth of about 1.2 m. It discharges over a weir at the west end of the lagoon, through a ditch directly to the East Channel after treatment. The facility does not conform to normal design criteria for sewage lagoon operation, however, it has provided an acceptable level of treatment over the years. Studies have indicated 85% reduction in suspended solids (SS) levels and a 70% reduction in Biochemical Oxygen Demand (BOD_5) during winter with higher reduction levels, up to 90% during the summer months. During the summer, long hours of sunlight and warmth promote high levels of algae growth and dissolved oxygen which allow for a relatively high level of sewage treatment, similar to southern lagoon installations. Some problems with the present facility include nuisance from odours due to sludge build-up near the raw sewage outfall, and a potential health risk as it is unprotected and in close proximity to the community. The Town and Territorial Governments are presently examining various alternatives to determine an acceptable standard of treatment for Inuvik's wastewater prior to discharge to the East Channel and to examine various practical alternatives to provide a level of treatment which will meet the Town's needs.

B.5 Garbage Collection and Disposal

Garbage collection and disposal is carried out by the Town's Public Works Department. The garbage is deposited in 205 L (45 igal) drums outside the homes along the sides of the streets. Burning in the barrels is carried out by many residents.

An open truck is used for garbage pick-up and the dump site is located approximately 1.5 km south of the Town centre, east of Boot Lake. Disposal is carried out using a land fill method.

B.6 Roads

The road system in Inuvik has improved to a large extent over the past few years with a street improvement and surfacing program which began in 1976. As part of the street improvement program, several subgrade designs have been used in various streets including soil cement on Wolverine Road and 100 mm thick rigid styrofoam subgrade insulation on Mackenzie Road. The pavement designs include 75 mm of hot mix surface course over a 100 mm asphalt bound base on major streets. Due to the presence of permafrost, most roadways are built on imported granular fill varying in depth up to 3 m. Permafrost thaw can exceed 3 m in disturbed areas with certain soil types.

The construction work in 1981 will complete subgrade improvement work and cold mix asphalt surfacing to the majority of the streets in Inuvik and complete sidewalks on Mackenzie Road. The various designs will be evaluated to assist in future road designs in the community.

B.7 Drainage

Overland drainage runs in shallow road ditches generally in a south- westerly direction. Ditches generally grade to culverts across Mackenzie Road which drain to the East Channel of the Mackenzie River. Most of the drainage problems have been alleviated in recent years as a result of the street improvement program.

B.8 Fire Protection

Inuvik has a permanent fire hall with a fire chief and a number of volunteer firemen ranging from 18 to 24. Fire fighting equipment includes the following:

- Thibault Pumper (1970) 2,273 L tank and 47 L/s pump
- King Seagrave Pumper (1976) 2,273 L tank and 80 L/s pump
- Ford Creen Cals (1976) Fire Chief's truck c/w 136 kg dry chemical unit
- GMC Vandura Van (1974) support unit
- IHC (1975) 11,365 L tanker c/w 19 L/s pump
- 12 m and 18 m ground ladders The alarm system includes 53 pole and wall mounted alarm boxes.

B.9 Other Services

NCPC generates and distributes power to Inuvik by means of diesel engine driven generators. The present output capacity is 15,260 KW. Other services include telephone, CCNT (microwave), a local newspaper ('The Drum'), CBC radio and television and daily mail service.

INFORMATION SOURCES

1. Associated Engineering Services Ltd., *Town of Inuvik, N.W.T. - Mackenzie Road Paving,* Design Report, January, 1978.

2. Associated Engineering Services Ltd., *Lake 'B' Water Supply Intake, Inuvik, N.W.T.,* October, 1978.

3. Associated Engineering Services Ltd., *Inuvik Water Distribution System Hydraulic and Thermodynamic Analysis,* Report for Town of Inuvik, N.W.T., August, 1978.

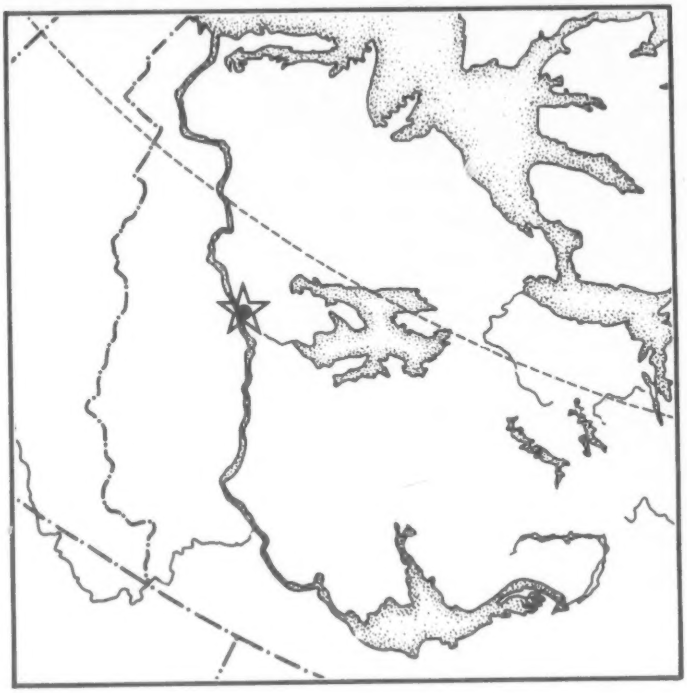
4. Associated Engineering Services Ltd., *Water Treatment Plant, Inuvik, N.W.T.,* Pre-design Report for Department of Local Government, Government of the Northwest Territories, February, 1978.

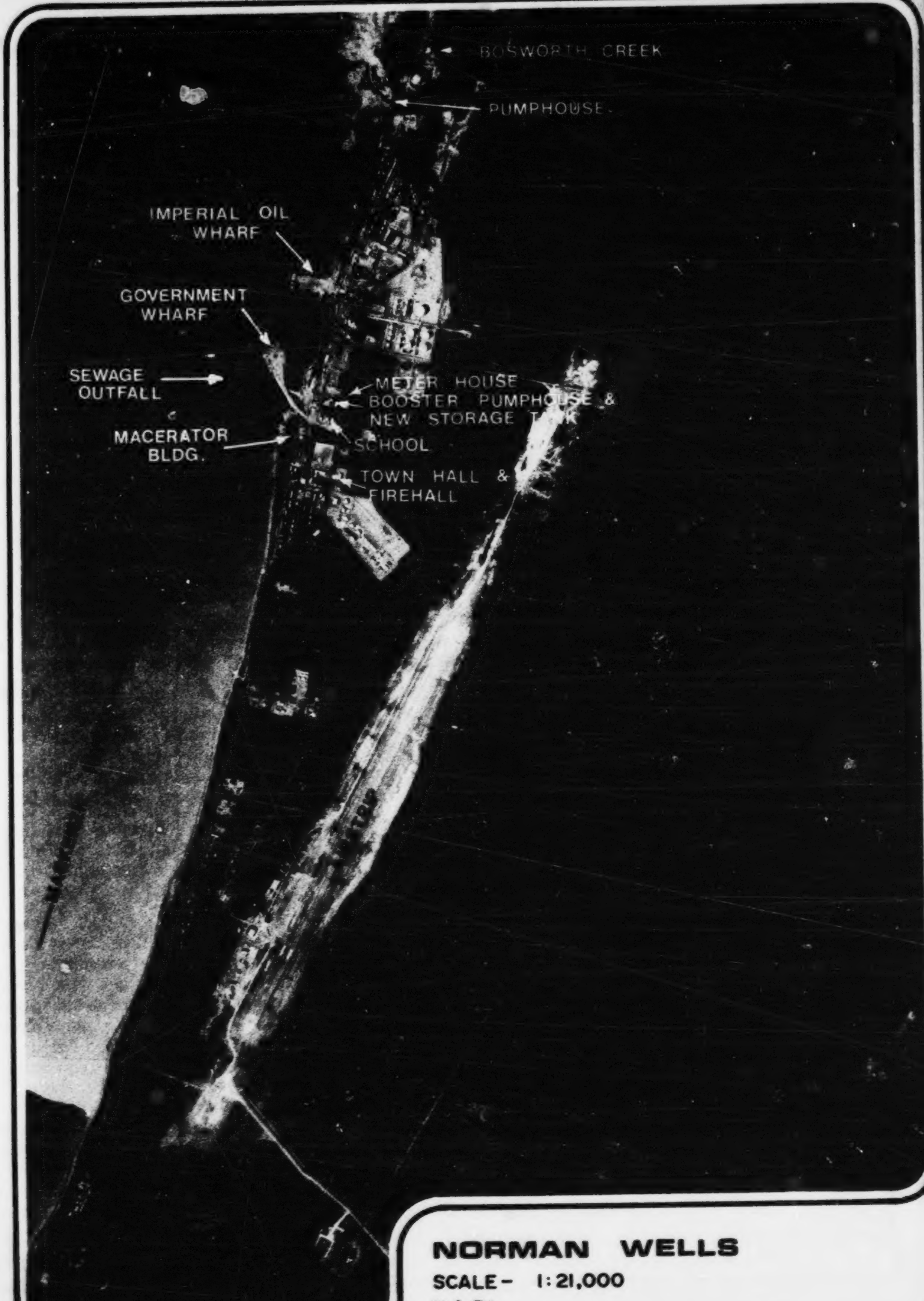
5. Underwood McLellan Ltd., *Inuvik General Plan -Background Report,* March, 1981.

6. Associated Engineering Services Ltd., *Pre-design Study of Sewage Treatment and Disposal, Inuvik, N.W.T.,* April, 1980.

7. Jacobsen, N.A., *Evaluation of a Sewage Lagoon at Inuvik, N.W.T.,* Masters Thesis, 1972.

Norman Wells




BOSWORTH CREEK
PUMPHOUSE
IMPERIAL OIL WHARF
GOVERNMENT WHARF
SEWAGE OUTFALL
METER HOUSE
BOOSTER PUMPHOUSE & NEW STORAGE TANK
MACERATOR BLDG.
SCHOOL
TOWN HALL & FIREHALL

NORMAN WELLS

SCALE- 1:21,000

N.A.P.L.
NO. A25240-135 & 136 1/8/79

Norman Wells — Bosworth Creek in foreground

A. GENERAL

A.1 Location

Norman Wells, on the north bank of the Mackenzie River, has a view of the entire width of the Mackenzie Valley, from the Franklin Mountains to the Richardson Mountains. The community's coordinates are 65°17'N latitude and 126°51'W longitude. It is 145 km (90 miles) south of the Arctic Circle and approximately 683 km (425 miles) by air northwest of Yellowknife.

The settlement is built on a section of the river bank 1680 m long by 250 m wide and 12 to 15 m above the normal river elevation.

A.2 History

Imperial Oil constructed a refinery at Norman Wells after commercial quantities of oil were discovered there in 1920. It was the first community in the Northwest Territories to be established as a result of resource development. The market for oil was limited for 20 years or so until demand by the mine at Port Radium increased production to 5000 barrels of crude per year. In 1939, a new refinery capable of producing aviation fuel was built. During the Second World War the Canol Project led to further expansion and production has since increased until today Imperial Oil Limited produces over a million barrels of crude oil per year.

Norman Wells is a major transportation centre in terms of air and river traffic. The company town is the supplier of fuel to communities further north as well as being important for airplane refueling and other freight, industry and mineral development related transportation services. Due to its importance as a distribution point, Norman Wells' continued development is assured.

A.3 Community Information

Norman Wells has a rather transient population of about 384 persons. Many people stay for only 2 or 3 years. Less than 6% of the residents are native. A gradual overall increase in population is apparent from the following population statistics:

POPULATION	YEAR
352	1978
361	1979
384	1980

A significant population increase can be expected upon expansion of Imperial Oil Limited's operation. This expansion will include increased oil production and a pipeline to carry crude to Alberta. There is little unemployment within the community.

The settlement of Norman Wells is divided into three residential areas. I.O.L. houses currently are situated in the west end, separated from the rest of the community by the refinery. Eventually all these homes will be relocated to the new subdivision close to the centre of the community.

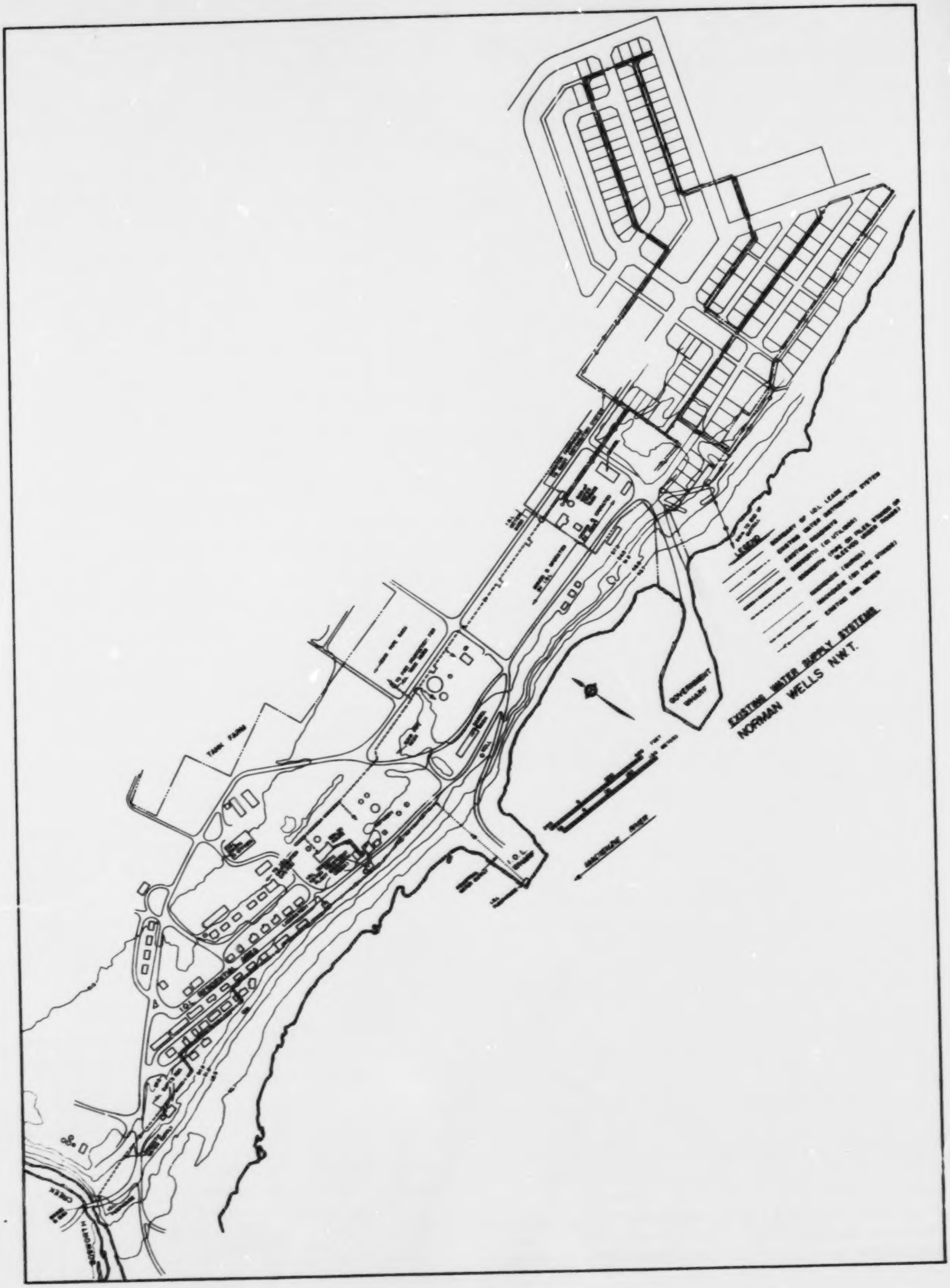
Government and transportation companies' personnel live in the central area near the school, store, R.C.M.P. and administrative offices. Further south along the river bank is a trailer park near the airport.

The licensed aerodrome is situated at an elevation of 73.5 m ASL with a paved airstrip 1829 m by 46 m (6000 ft. by 150 ft.). It is located on an esker northeast of the community (see aerial photo).

A.4 Geology and Terrain

Norman Wells is south of the limit of continuous permafrost, however the soil has a high ice content, is unstable and is subject to heaving.

The top 3 to 6 m of soil in town is fluvial silt and sand. Underneath are layers of shale and sandstone. The active layer is 0.5 to 1.5 m in fine grained soils. Degradation of the permafrost occurs when the organic cover is removed and the active layer may increase to between 3 to 5 m. Permafrost extends 45 m down from the ground surface.



EXISTING WATER SUPPLY SYSTEMS
NORMAN WELLS N.W.T.

LEGEND
BOUNDARY OF I.O.L. LEASE
EXISTING WATER DISTRIBUTION SYSTEM
GOVERNMENT WHARF
TANK FARMS
I.O.L.
MACKENZIE RIVER
CREEK

Norman Wells refinery

A quarry was developed near the garbage dump on a limestone ridge. Isolated pockets of sand and gravel may be found in the eskers by the airport runway.

A.5 Vegetation

On the better drained areas black spruce, tamarack, white birch, and alder grow. Portions of the surrounding terrain are muskeg with mosses, grasses and bushes.

A.6 Climate

Norman Wells has an average of 126 frost-free days per year. The mean daily temperature in January is -28.7°C and the mean daily temperature in July is 16°C. About 195 mm of rain falls each year. The average annual snowfall is 1433 mm.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Norman Wells obtains water from two sources; a small reservoir on Bosworth Creek and an intake into the Mackenzie River. All water supply facilities are owned and operated by Imperial Oil Ltd.

Water for domestic use flows by gravity from an intake behind a dam on Bosworth Creek. Both the dam and intake were reconstructed in 1972. A wet well receives the raw water at the Bosworth Creek pumping station. A small filtration plant is located 732 m from the pumphouse. Subsequently, the water is chlorinated in a boiler house and directed to the Imperial Oil residences. All these facilities are on Imperial Oil property near the refinery.

Excess chlorinated water is metered and pumped to a booster pumping station and is stored in two tanks. From there heated water is sent through the utilidor system or trucked to homes in the remainder of Norman Wells.

Approximately one winter in four, Bosworth Creek freezes to the bottom cutting off water supply to the reservoir. Imperial Oil maintains an industrial water supply intake into the Mackenzie River by their wharf. The river water is of good quality in the winter and has the capability of acting as a back-up water source. However, this intake is downstream of the sewage outfall.

B.1.2 Source

The reservoir on Bosworth Creek has a depth of 3.5 m at its deepest point, a width of 30 m, and a length of 150 m. The estimated mean daily flow of the creek is 0.28 m^3/s (10 cfs). This flow is considered adequate to meet the community's potable water requirements.

Bosworth Creek — intake/pumphouse

The water quality is generally adequate for domestic use. Below are the results of water sample analysis taken on May 23, 1978 by M.M. Dillon, Consulting Engineers and Planners. (All values in mg/L unless otherwise indicated)

Constituents	Bosworth Creek Water	Tap Water
pH	7.9	8.0
Hardness (Total) as $CaCO_3$	190	198
Sulphate (SO_4)	86.0	99.0
Iron (Fe) Total	0.57	1.47
Colour (APHA)	62.0	60.0
Turbidity	26.0 units	16 units
Calcium (Ca)	46.4	50.5
Magnesium (Mg)	18.1	17.4
Bicarbonate (as CO_3)	138.0	130.0
Total Dissolved Solids	303.0	322.0
Suspended Solids	35.6	3.6
Total Copper (Cu)	<0.005	0.27

The results seem to indicate some corrosion in the piping or storage tanks. The water is somewhat hard and iron bacteria is blamed for the reddish brown colour of tap water.

The Mackenzie River water requires treatment for turbidity in the spring and summer. Imperial Oil prefers the Mackenzie River water for industrial use to that of Bosworth Creek because it is softer.

Old and new water distribution systems

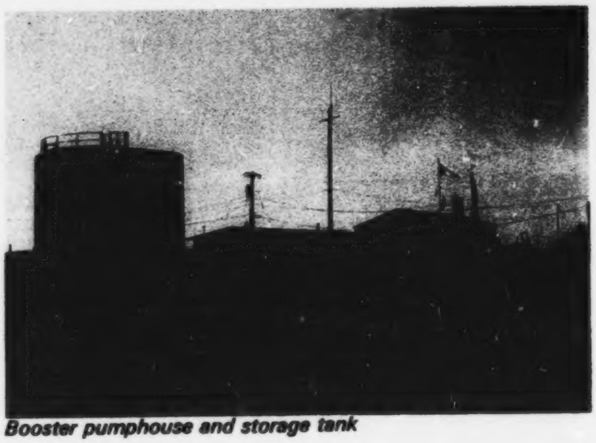
B.1.3 Intake Facilities

(a) Domestic Water Supply

The Bosworth Creek Dam incorporates a bridge above steel sheet piling backed by rock rip-rap. The spillway is 17 m wide, 2.3 m below the bridge beams.

Both the intake and pumping station were constructed in 1963. The raw water intake is 250 mm in diameter and has a length of 17 m from its inlet to the pumping station's wet well.

The inlet consists of a closed end, 250 mm steel pipe with 16 slots (305 mm by 13 mm). The inlet rests on steel pipe supports about 0.6 m above the bottom.


Booster pumphouse and storage tank

Normal water depth above the inlet is reported to be about 2 m. The first 6.1 m of the intake is flexible suction hose, which may be raised for inspection of the inlet. The remaining 10.7 m is buried steel pipe which is heated by steam. The inlet and intake conduit function satisfactory despite the relatively shallow depth.

The intake discharges by gravity to the wet well of the pumping station. The wet well consists of a 7.6 m long steel pipe which is 510 mm in diameter.

The intake conduit enters the wet well about 5.2 m below the floor of the pumping station, i.e. 2.4 m above the bottom of the wet well. Steam heat tracing of the wet well is provided above the intake conduit.

Static water level in the wet well is normally about 3.5 m below the floor of the pumping station.

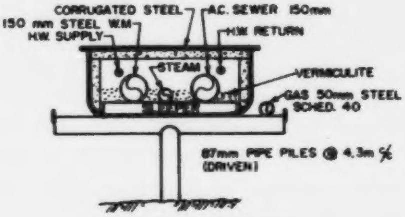
(b) Industrial Water Supply

The industrial water intake is located at Imperial Oil Limited's dock on the Mackenzie River and consists of two wet wells within the sheet pile perimeter of the dock. Water enters each wet well via eight slots (50 mm by 915 mm) in the sheet piling. The depth at the inlets is shallow (1.2 to 1.8 m) under normal river water level conditions.

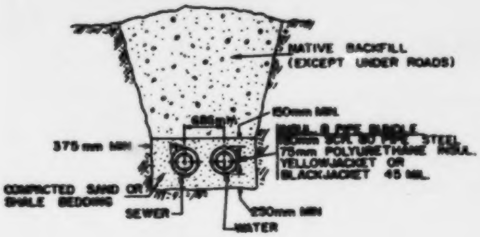
Each wet well contains a submersible electric pump. The pumps discharge through 350 m of 200 mm diameter steel pipeline to the industrial water storage tank adjacent to the domestic filtration plant. The 168 m of the pipe nearest to the plant is elevated on steel frame supports and the remaining 183 m is buried in the dock and the river bank.

At the domestic filtration plant, the water from the storage tank is re-pumped through about 152 m of main, which parallels the domestic main, to Imperial Oil Limited's boiler house.

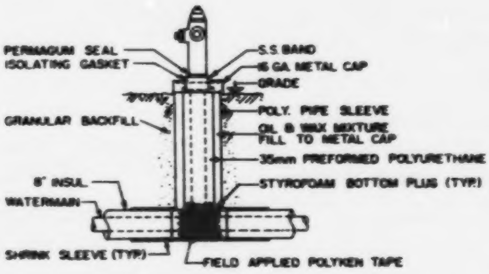
Imperial's 1976 industrial water use averaged 1,855,000 Lpd (408,000 Igpd). During power failures, creek water is used for the refinery. Excess water is diverted to a settling pond. Pressure in the oil wells is raised with this water.


CORRUGATED STEEL
A.C. SEWER 150mm
150 mm STEEL W.M.
H.W. SUPPLY
H.W. RETURN
STEAM
VERMICULITE
GAS 50mm STEEL SCHED. 40
SLEEPER
87mm PIPE PILES @ 4.3m C/C (DRIVEN)

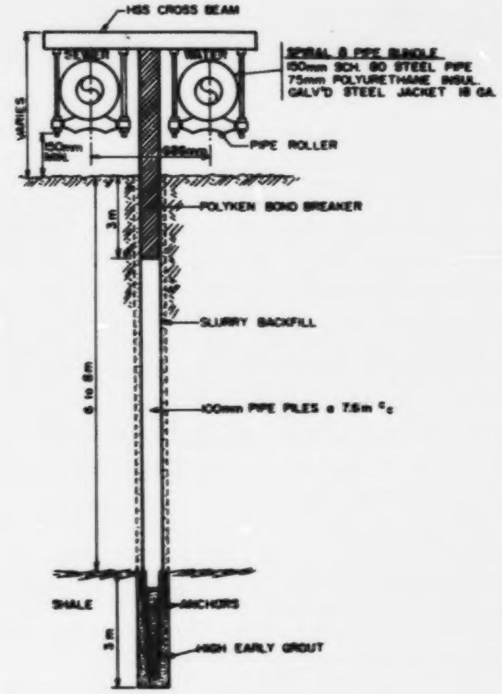
MAIN TRUNK UTILIDOR


NATIVE BACKFILL (EXCEPT UNDER ROADS)
150mm MIN
686mm
SPIRAL 8 PIPE BUNDLE
150mm SCH. 80 PIPE STEEL
75mm POLYURETHANE INSUL.
YELLOWJACKET OR
BLACKJACKET 45 MIL
375 mm MIN
COMPACTED SAND OR SHALE BEDDING
SEWER
230mm MIN
WATER

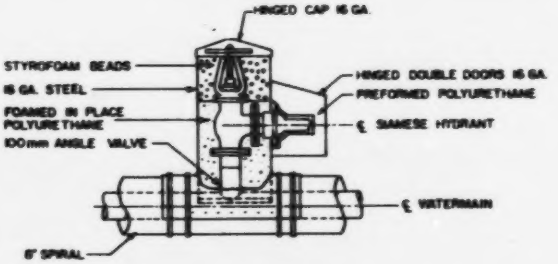
BURIED MAINS


PERMAGUM SEAL
ISOLATING GASKET
S.S. BAND
16 GA. METAL CAP
GRADE
GRANULAR BACKFILL
POLY. PIPE SLEEVE
OIL & WAX MIXTURE FILL TO METAL CAP
35mm PREFORMED POLYURETHANE
8" INSUL.
STYROFOAM BOTTOM PLUG (TYP.)
WATERMAIN
SHRINK SLEEVE (TYP.)
FIELD APPLIED POLYKEN TAPE

BURIED

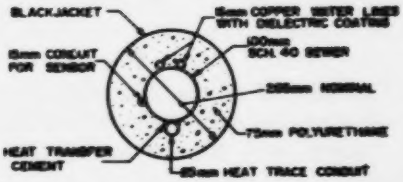

HSS CROSS BEAM
SEWER
WATER
SPIRAL 8 PIPE BUNDLE
150mm SCH. 80 STEEL PIPE
75mm POLYURETHANE INSUL.
GALV'D STEEL JACKET 18 GA.
VARIES
150mm MIN
686mm
PIPE ROLLER
POLYKEN BOND BREAKER
3m
SLURRY BACKFILL
6 to 8m
100mm PIPE PILES @ 7.5m C/C
SHALE
ANCHORS
HIGH EARLY GROUT
3m

ABOVE GROUND MAINS

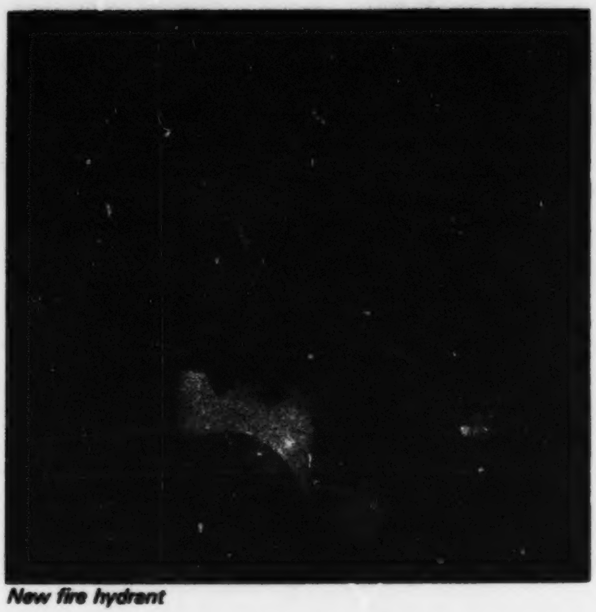

HINGED CAP 16 GA.
STYROFOAM BEADS
16 GA. STEEL
HINGED DOUBLE DOORS 16 GA.
PREFORMED POLYURETHANE
FOAMED IN PLACE POLYURETHANE
℄ SIAMESE HYDRANT
100mm ANGLE VALVE
℄ WATERMAIN
8" SPIRAL

ABOVE GROUND

TYPICAL HYDRANT DETAILS


BLACKJACKET
15mm COPPER WATER LINES WITH DIELECTRIC COATING
100mm SCH. 40 SEWER
15mm CONDUIT FOR SENSOR
255mm NOMINAL
75mm POLYURETHANE
HEAT TRANSFER CEMENT
20mm HEAT TRACE CONDUIT

BURIED HOUSE CONNECTION BUNDLE



New fire hydrant

B.1.4 Treatment Facilities

The filtration plant is a 7 m by 11.3 m insulated metal clad building which contains the following:

A. Two 'Permutit' pressure filters using sand media, 1.83 m in diameter and rated for 276 kPa working pressure. The filters are rated at 409 to 455 Lpm in parallel operation. The filters only reduce turbidity; no pretreatment is provided ahead of the filters, which reduces their effectiveness. New cyclone filters are to be installed in 1980.

B. Valves which allow parallel operation of filters, single filter operation or filter bypassing. Backwash piping (100 mm) is provided.

C. A fire pump.

D. Booster and standby pumps were installed for the industrial water supply. The 159,000 L (35,000 Igal) heated storage tank for industrial water is located adjacent to the filtration plant.

A 200 mm supply line enters from the Mackenzie River.

After filtration, the domestic water is pumped to the boiler house and gas chlorinated. From there the water is sent through a 150 mm main, metered at Imperial Oil's meter house and then flows 46 m further to the booster pumping station or distribution point.

At the boiler house the industrial water may be filtered and softened. Subsequently, it is used for boiler feed, cooling and service water for the refinery complex.

B.1.5 Storage Facilities

(a) Domestic Water Storage

The booster station, completed in 1975, is an insulated metal clad structure on a pile foundation. The station has the following uses: it provides a metered fill point for water trucks; it pumps heated water through a utilidor system; and it contains a tank used for fire and balancing storage.

A tank within the pumphouse holds 68,200 L (15,000 Igal) of filtered, chlorinated water. About 13,650 L (3000 Igal) are designated as balancing and dead storage. The remaining 54,550 L (12,000 Igal) are reserved for fire storage. This tank is used to heat water prior to distribution.

In 1978, a 910 m³ storage tank was erected in the school yard across from the RCMP building. The polyurethane foam insulation is protected by metal cladding. McDonnell-Douglas 'Cyro-anchors' or heat pipes were installed to prevent degradation of the frost susceptible subsoils beneath the tank. This tank is also used for fire storage and balancing.

(b) Industrial Water Storage

An insulated heated 159,000 L (35,000 Igal) tank stores water for industrial supply next to the filtration plant.

B.1.6 Pumping Facilities

(a) Domestic Water Supply

The Bosworth Creek Pumping station contains the following pumps:

1.	Function:	to pump domestic raw water from wet well to filtration plant.
	Type:	Weinman horizontal centrifugal pump
	Capacity:	Rated at 33 L/s @ 343 kPa (438 Igpm @ 115' TDH)
	Motor:	natural gas engine at 1750 RPM
2.	Function:	Standby pump
	Type:	Peerless 5-stage vertical turbine with submersible electric motor.
	Model:	Peerless Model 10 MA5-30
	Capacity:	31.5 L/s @ 507 kPa TDH (417 Igpm @ 170' TDH)
	Motor:	26 HP, 1760 rpm, 440 v, submersible electric

The actual discharge of the Weinman pump measured by M.M. Dillon in 1976 was 545 Lpm (with the filters bypassed) due partly to the system losses and partly to the fact that the pump is limited to operation at 1750 rpm. Similarly, the standby pump discharge is 7.5 L/s under operating conditions. The two pumps cannot be used in parallel. The booster pumping station contains the following pumps:

1. Function: duty pump for supply to water distribution systems
   Type: horizontal centrifugal with 10 hp electric motor
   Model: A.F. Clarke Model 20121-133200
   Capacity: rated 5.7 L/s @ 373 kPa TDH (75 Igpm @ 125′ TDH)
2. Function: Standby pump
   Model: A.F. Clarke Model 20121-133200
   Capacity: 5.7 L/s @ 373 kPa TDH (75 Igpm @ 125′ TDH)
3. Function: fire pump
   Type: horizontal centrifugal with Deutz diesel engine
   Capacity: 19 L/s @ 687 kPa (250 Igpm @ 230′ TDH)
4. Function: hot water recirculation pump
   Type: in-line circulating pump with electric motor
   Model: Armstrong 11/4D4280
   No.: 2 - 1 standby
   Capacity: 2.25 L/s @ 358 kPa TDH (30 Igpm @ 120′ TDH)
   Motor: electric 5 HP

A heat exchanger and 6 gas hot water heaters heat the water before it is sent through the pipes in winter.

(b) Industrial Water Supply

Each wet well at the Mackenzie River inlet contains the following pump:

Type: Submersible electric pump
Model: Marlow Type 6SM3
Function: pumps water to 159,000 L storage tank

The filtration plant contains a booster pump for industrial water supply and a standby pump.

B.2 Water Supply and Distribution Piping

B.2.1 Bosworth Creek to Filtration Plant (Supply Line)

The raw water main consists of about 730 m of 150 mm (6″) welded steel pipe. This line is relatively new having been reconstructed by Imperial Oil Limited in phases from 1971 to 1973.

The first 177 m of pipe line from Bosworth Creek is elevated on steel 'T' pile supports. The pipe has about 40 mm thick insulation protected by a 355 mm diameter aluminum jacket and is heated by steam tracing.

A similar elevated pipe line is used for the 95 m immediately upstream of the filtration plant.

The intermediate 457 m of pipe line is carried in Imperial Oil Limited's heated and insulated utilidor system.

B.2.2 Filtration Plant to Booster Pumping Station:

The filtered water pipe line consists of 838 m of 150 mm diameter and 46 m of 100 mm diameter welded steel line, as follows:

- filtration plant to chlorination plant in the boiler house - 152 m of 150 mm pipe

- boiler house to 'Tee' for Imperial Oil Limited domestic supply - 46 m of 100 mm pipe

- Imperial Oil Limited 'Tee' east to Imperial Oil Limited Meter House - 640 m of 150 mm steam traced, insulated and T pile supported pipe

- meter house to booster station - 46 m of 150 mm, steam traced, insulated and T pile supported, with steam and gas lines

The supply line extending from the Bosworth Creek pumphouse to the booster station has been subject to interior scaling and build-ups causing problems in transmission. This line is to be replaced in 1981. This is to be carried out in conjunction with the enhancement of the storage facilities at Bosworth Creek.

B.2.3 Distribution Systems

The community is divided into three main serviced areas. The refinery and associated residential development is at the west end of the community, and further east near the airport is a mobile home park.

(a) I.O.L. Residential Area

The northern utilidor system serves about 20 buildings and also provides water and natural gas to the system to the south. Exclusive of utilidettes, there is about 793 m of utilidor in this system.

The main trunk utilidor contains a 150 mm asbestos cement gravity sewer, a 150 mm diameter steel water main, and 50 mm hot water supply and return lines. A 75 mm gas line is carried outside the utilidor box on the same pilings. This type of utilidor system also extends south of the booster station to the central residential area.

Branch utilidors are of two sizes:

- 0.9 m by 0.5 m containing 150 mm water main, 150 mm gravity sewer, 50 mm hot water supply and 50 mm hot water return pipes
- 0.6 by 0.5 mm containing 75 mm water main, 150 mm gravity sewer, 50 mm hot water supply and 50 mm hot water return

Three fire hydrants are installed on the main trunk of the utilidor system.

The maximum spacing between hydrants is about 155 m. Gas lines are attached to the outside of the utilidors.

The utilidors are laid out on a branched system with no loops in either the water or sewer system.

(b) Central Residential Area

The main utilidor system services about 29 buildings in the center section of Town as well as a small new subdivision.

A surface utilidor system was installed in 1976 to service the new subdivision of Territorial Housing dwellings. Water lines are 150 mm Schedule 80 welded steel pipe insulated with 75 mm of polyurethane foam. Freezing of the water main is prevented by continuous circulation of heated water except for a short section between the booster station and the Norwel Inn. Glycol circulates through that portion of the system.

The essential elements of the system are a single loop circulating distribution main, preheating facilities and circulation pumps located in the existing booster station and, a large heated water storage reservoir. Treated water is received from Imperial Oil Limited, preheated to about (10°C) as required, and stored in the reservoir. From the reservoir it is circulated around the loop and back to the reservoir. Sufficient heat is available to provide heat to the reservoir and mains, and to allow for heating of all present and future house service connections by recirculation.

In the event of water main freeze-up, thaw lugs were welded to the pipe at weld joints every 13 m. The lugs are bolted to a heavy copper welding cable which may be attached to a welder to heat the pipe. The mains were also graded to drain by gravity if required.

Subsurface water and sewer lines were installed in the older central subdivision in 1976. The water main was also 150 mm Schedule 80 insulated welded steel pipe. It was designed for easy drainage from two low points.

Thermistor readout stations were installed in both above and below ground water and sewer lines. Monitoring of the water and waste temperatures will help identify ice formation and other problems before there are serious consequences.

Macerator building

Above ground hydrants are enclosed in prefabricated, pre-insulated sheet metal enclosures. Buried hydrants are on-line, using pre-formed insulation half-shells in tees connecting to the mains (see illustration).

Residences without connections to the utilidors have their water trucked from the booster pumping station. Water delivery in 1980-81 was privately contracted to G. Cowtowea.

B.3 Sewage Collection and Disposal

B.3.1 General

Gravity sewers in the utilidors are accessed by most of the buildings. Until a new sewage outfall was constructed in 1978, raw sewage was collected in central septic tanks in the residential areas and then discharged through 4 or more outfalls over the river bank into the Mackenzie. A new central facility incorporating a macerator now collects all domestic sewage from the central residential area and discharges it through a submerged outfall into the river. Waste from the refinery boiler house, and drum plant is collected separately, passed through a separator system to remove oil and is also discharged to the river.

Sewage wastes from the I.O.L. residential area is collected by gravity sewers discharging into two septic tanks which ultimately discharge directly to the Mackenzie River.

The Mackenzie River is easily able to assimilate the organic loadings. Average daily flows in the river are greater than 8500 m^3/s (300,000 cfs) making the dilution factor high. M.M. Dillon (1978) (Ref. No. 5) projected the following hydraulic and organic loadings by the Norman Wells sewage system:

DAILY LOADINGS

Year	Total Sewage Flow	Raw Sewage BOD's	Raw Sewage S.S.
1976	168 m³ (37,120 Ig)	42 kg (92.8 lbs.)	42 kg
1986	249 m³ (54,886 Ig)	62 kg (137.2 lbs.)	62 kg
1996	369 m³ (81,360 Ig)	92 kg (203.4 lbs.)	92 kg

Sewage flows were based upon 363 Lpcd (80 Igpcd). No allowance was made for infiltration due to the nature of the collection system.

Biochemical Oxygen Demand (BOD_5) and Suspended Solids (SS) values were obtained from an assumed 0.09 kg (0.2 lbs) per capita per day.

Mathematical modelling undertaken by the University of Waterloo showed that for the 1978 population of Norman Wells, 95% of raw sewage BOD was measured within the dispersion plume would be eliminated within 1 km downstream of the outfall.

B.3.2 Piped Collection System

In 1976, a new underground and above ground utilidor was constructed when the existing utilidor in the central residential area required replacement.

The above ground system serves the small new subdivision north of the core area. It consists of 150 mm Schedule 80 welded steel pipe with 75 mm of polyurethane foam covered by spiral wound 16 gauge galvanized steel, for both water and sewer lines. The pipes are suspended from crossbeams welded to Schedule 40 steel pipe used for piles. Warm water is bled off from the water main to prevent the sewage from freezing. There are cleanouts every 60 m on the sewer main to allow a steam hose to thaw the line.

The below ground system in the older central subdivision differs from the above ground piping in that the insulation is covered with a 45 mil yellow jacket. The manholes are 10 mm steel plate insulated with 50 mm of high density styrofoam. All sewage flows by gravity to the macerator building on the river bank upstream of the government wharf.

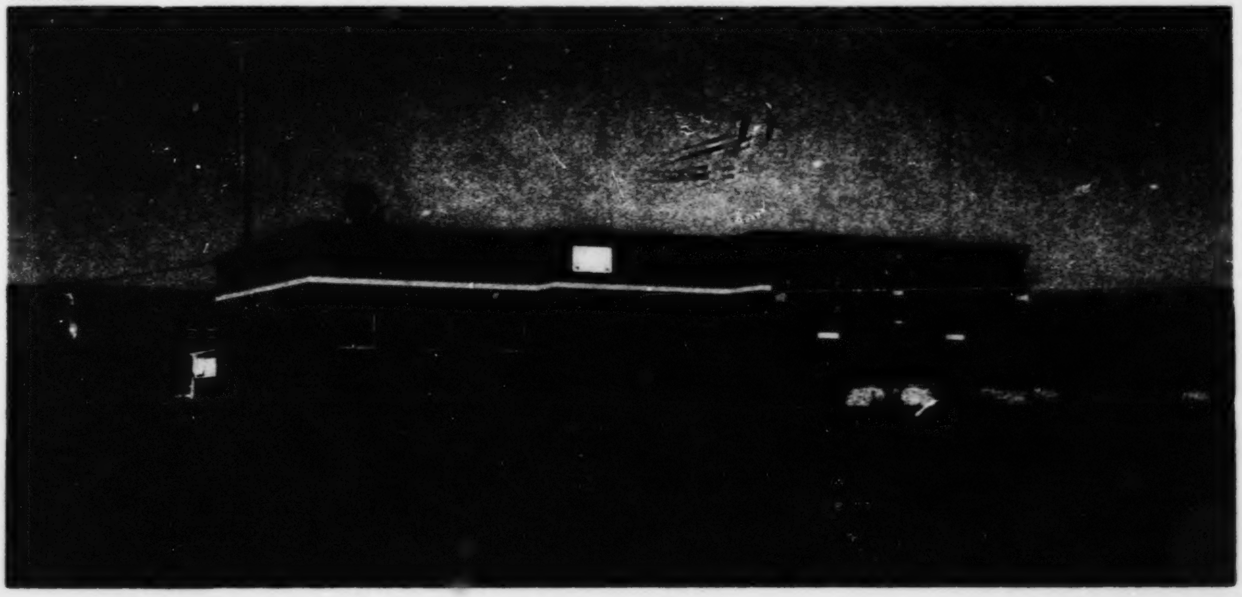
B.3.3 Sewage Pumpout

Sewage is pumped from holding tanks in the east end of the settlement where there is no utilidor. The sewage is trucked to the central treatment building where it is discharged into the macerator system.

B.3.4 Sewage Disposal

The sewage treatment plant building is situated on piles. This macerator building is actually a large freezer and was used instead of a conventional prefabricated structure because of its superior insulation. A buried 250 mm steel insulated outfall line carries raw waste from the building after maceration to the river, a distance of 76 m. The sewage is transferred through a manhole to an uninsulated pipe which extends 541 m into the Mackenzie River. The insulated portion is weighted down by anchors. Two 100 mm diffusers spaced 30.5 m apart extend downstream from the end section of the outfall.

Fire Hall



B.4 Solid Waste Collection and Disposal

Garbage was collected under contract with Norman Wells Transportation in 1980-81. The dump is located inland past the airport runway.

B.5 Roads and Drainage

The internal roads are well maintained except where there is heavy truck traffic. Shale is used as a fill material and is slippery when wet. No roads are paved, instead they are oiled to keep the dust down.

B.6 Fire Protection

In the event of fire, an operator notified by phone activates the alarm. The fire truck - a 1974 wheeled standard triple combination pumper is kept in a fire hall. There are about 10 volunteer firemen. The aerodrome has its own mini-pumper.

B.7 Other Services

Transportation services in Norman Wells include NTCL bulk oil and freight shipment by barge, Pacific Western Airlines, air charter companies, taxi service, and car and truck rentals. PWA has scheduled flights to Inuvik, Edmonton and Yellowknife.

The settlement has few recreation facilities. Community services include telephone, T.V., radio and telex service, mail delivery 6 days per week, a nursing station, an elementary school and a church.

NCPC provides power with diesel generator facilities (2000 kw capacity).

Minipumper

INFORMATION SOURCES

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2. M.M. Dillon, Consulting Engineers and Planners, *Norman Wells, N.W.T. Water Supply Study,* February, 1976.

3. Associated Engineering Services Ltd., *Engineering Report to G.N.W.T. on Norman Wells, N.W.T.,* 1970.

4. M.M. Dillon, *Norman Wells, N.W.T. Sewage Treatment & Disposal Feasibility Study,* April, 1978.

5. Richard Nancarrow, *Work Report on Norman Wells Water and Sewer Services,* Fall, 1976.

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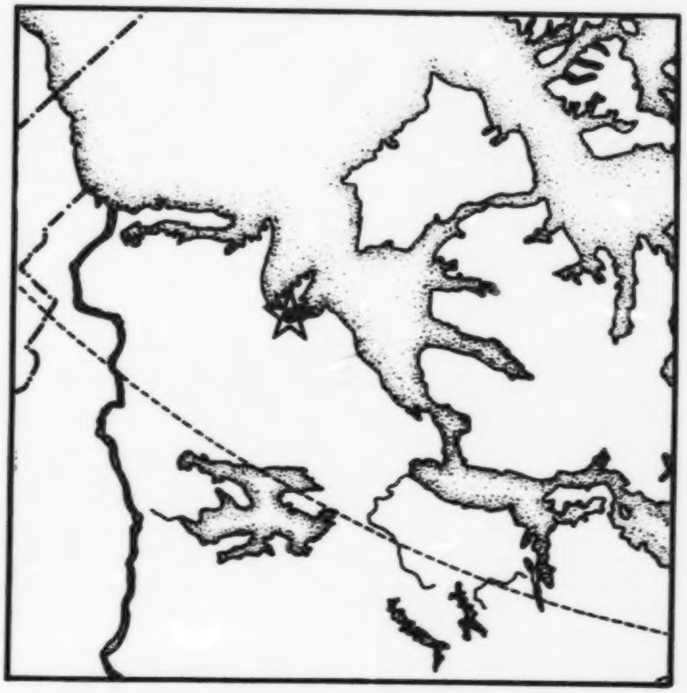
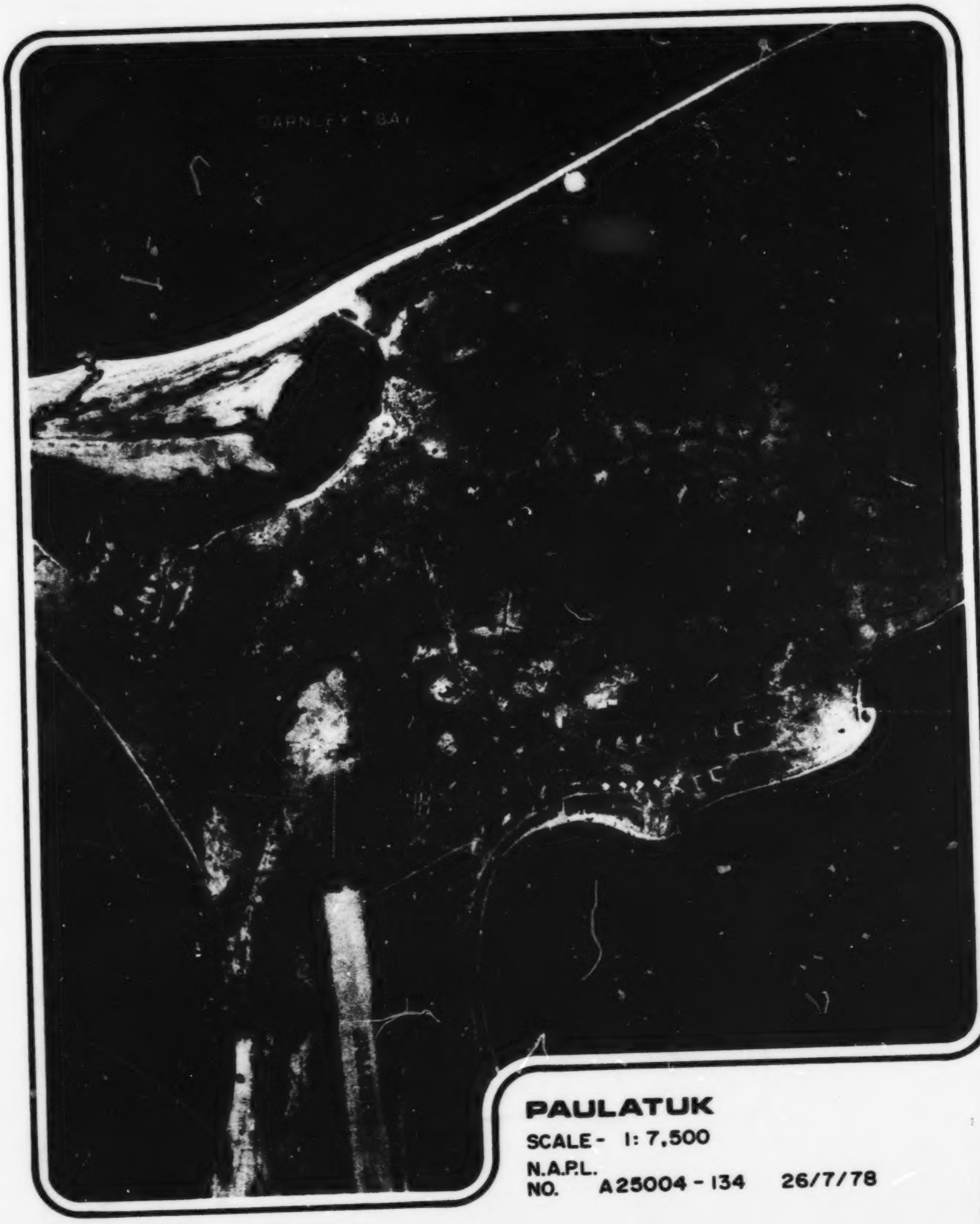
Paulatuk




DARNLEY BAY

PAULATUK

SCALE - 1: 7,500

N.A.P.L.
NO. A25004 - 134 26/7/78

Homes in Paulatuk

A. GENERAL

Paulatuk is a settlement located approximately 400 air km east of Inuvik at the south end of Darnley Bay on the Arctic coast. It's co-ordinates are 69°49'N latitude, 123°59'W longitude.

The Roman Catholic Mission opened a trading post at the site in 1935. Much of the population moved away in the 1950's when the post closed. Since then a Co-op was established and Inuit re-settled there. The name Paulatuk is an Inuit word meaning 'soot of coal' as coal is found in the vicinity.

This Inuit community has settlement status. The population has been fairly stable over the last 3 years as shown by the following:

POPULATION	YEAR
163	1978
168	1979
169	1980

The economy is based on hunting, fishing, sealing and handicrafts. Services include an elementary school, a visiting health nurse and two churches.

The sand surfaced airstrip is 975 m by 30 m at 15 m A.S.L.

The community was built between the seashore and an inland lake, on silt and sand with a high moisture content. Gravel is scarce in the region which is predominantly muskeg. The site is underlain by continuous permafrost.

Dry sandy areas contain grasses, mosses and lichens. Relatively lush vegetation consisting of reed grasses, sedges and mosses are found in the lower wet areas. Some dense stands of willows may be found in the delta regions of rivers.

The July mean high temperature is 18.8°C and the mean low is 8.3°C. The January mean high and low temperatures are -24.9°C and -32.7°C respectively. Rainfall averages 102 mm per year and the mean annual snowfall is 1,267 mm. Prevailing winds are easterly at 14.5 km/h.

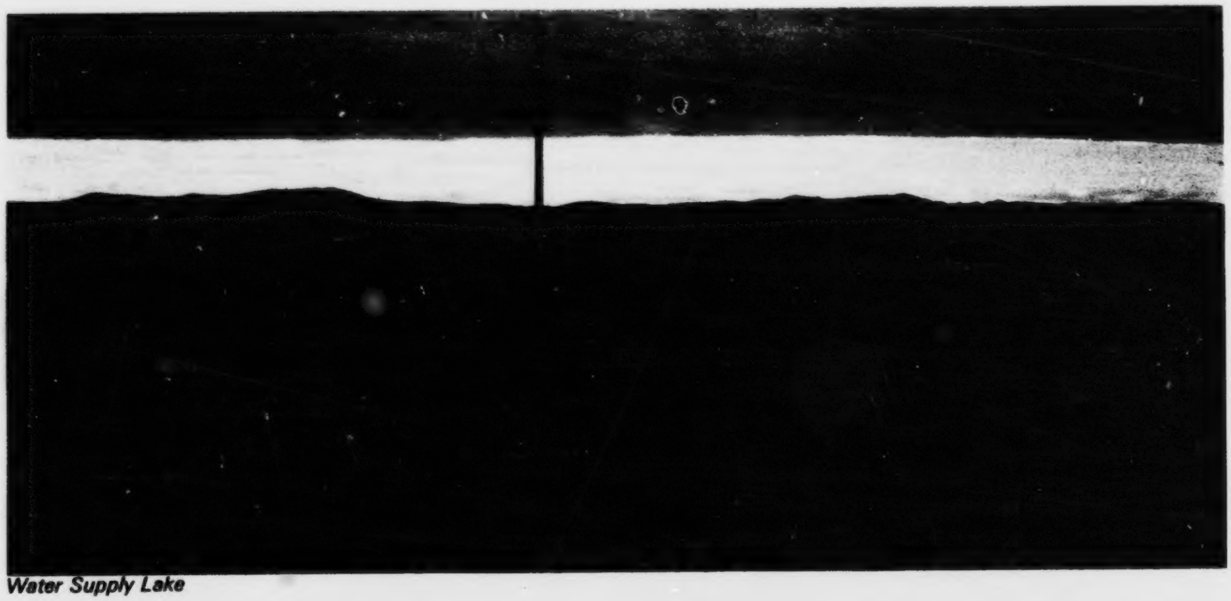
B. MUNICIPAL SERVICES

B.1 General

Water is delivered using a water truck. The entire community utilizes bagged sewage. The latter is picked up regularly and disposed of with the garbage. The Paulatuk settlement handles the water delivery, as well as the bagged sewage and garbage pick-up contracts.

B.1.1 Water Supply

Most of the homes within the community are equipped with two 205 L drums for potable water storage. Water is hauled three times weekly by the Co-op from the nearby freshwater lake. The lake is located near the airstrip about 1 km south of the community. A 4500 L water storage tank is filled once per



Water Supply Lake

week during the summer and functions as a community water point. The settlement school is equipped with a 680 L storage tank which is filled regularly.

During the winter, many residents use ice to supplement their water supply.

B.1.2 Sewage and Garbage

All homes within the community are equipped with bucket toilets. The bagged sewage and garbage is collected weekly by the settlement and hauled to a disposal site across the peninsula adjacent to the ocean shore.

B.2 Roads and Drainage

There are no roads as such in the community other than tracks with surfaced road leading to the airstrip.

Drainage poses no serious problems since the community is strung out along a sand and gravel bluff about 3 m above sea level.

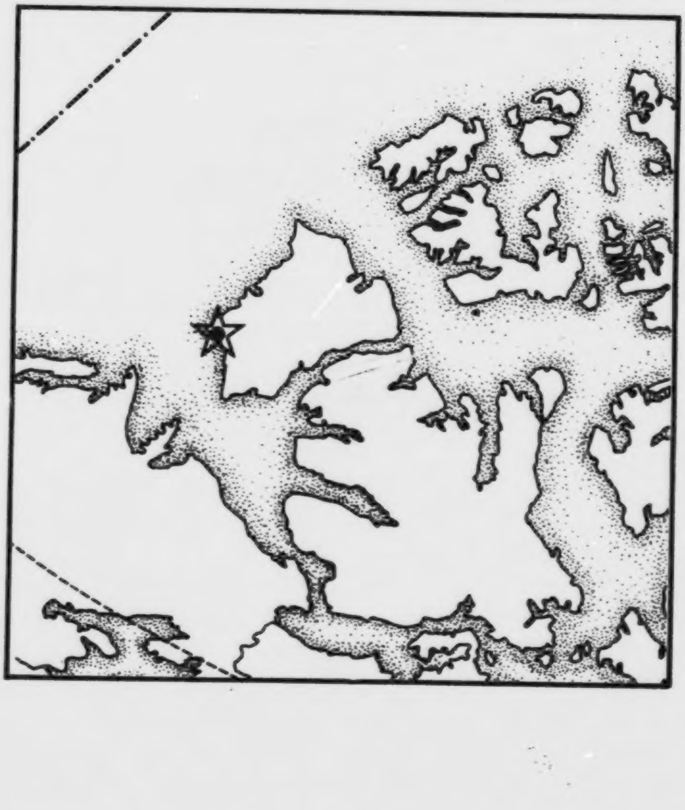
B.3 Fire Protection

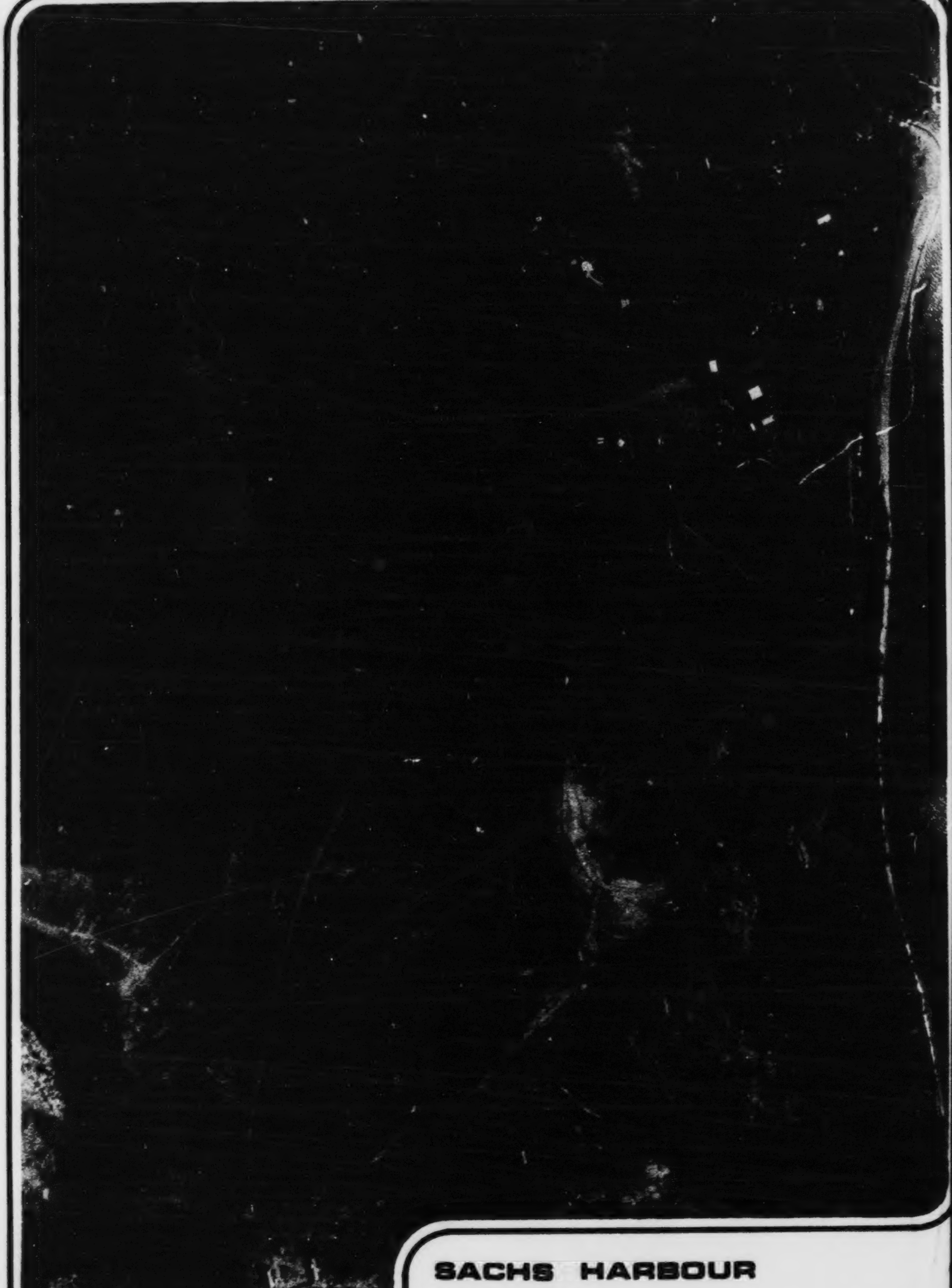
Fire protection is limited in the community. A dry chemical fire extinguisher is available plus 8 volunteers.

B.5 Other Services

Communication is provided with a radiophone. No radio or television services exist in the settlement.

Sachs Harbour





SACHS HARBOUR

SCALE - 1:7,000

N.A.P.L.

NO. A25222-8 & 10 23/7/79

A. GENERAL

Sachs Harbour is a small Inuit community on the southwestern shore of Banks Island. It is 523 air km northeast of Inuvik and 1158 air km northwest of Yellowknife. The co-ordinates are 71°59'N latitude and 125°13'W longitude.

The harbour was named after the ship 'Mary Sachs' of the Canadian Arctic Expedition in 1913. A permanent settlement was established in 1929 when 3 Inuit families moved there to trap. In 1953 the RCMP set up a detachment post.

An Atmospheric Environment Station (A.E.S.), with facilities to accommodate up to 25 persons, is near the settlement. Most of the rest of the inhabitants are Inuit. The population is not expected to grow significantly. Recent statistics are as follows:

POPULATION	YEAR
177	1978
173	1979
172	1980

Hunting and trapping form the economic base of the community. Sachs Harbour is reputed to be in the best White Fox trapping area of the northern Arctic. Although oil exploration is underway on Banks Island, this has not affected the settlement significantly.

A gravel surfaced airstrip (1220 m x 30 m) is located north of the settlement at an elevation of 86 m ASL.

The buildings are strung out on hillocks above the shoreline. The soils are glacier deposited clay and mixed gravel. There are very few ice lenses and the soil is impervious, so building foundation conditions are good in the settlement. In drainage areas, ice wedges occur in alluvial deposits of black organic silt.

Permafrost is continuous and the active layer in the fine grain soil is less than 0.5 m, increasing to 1 m where vegetation has been disturbed.

Vegetation cover is thin and consists mainly of mosses and lichens with some grasses.

Sachs Harbour has a very cold dry climate. There is an average of 51 frost free days per year. The mean annual rainfall is 45 mm and the annual snowfall averages about 580 mm. The mean daily temperature in July is 6°C. The corresponding temperature in February, the coldest month, is -31°C.

B. MUNICIPAL SERVICES

B.1 General

Traditionally, the inhabitants collected snow and melted it for domestic use. After the snow disappeared in late June, they would row up the Sachs River 13 km to obtain fresh water. The Atmospheric Environment Station (A.E.S.) used the water from a small lake about 1.5 km northwest of the settlement for domestic water supply (see aerial photo).

In 1978, an intake facility and pumphouse was built by that lake so the people could enjoy a year-round supply. Water is pumped from this lake along a water main to a truck fill point. Trucks are filled at the pumphouse for water delivery to the settlement houses. The A.E.S. buildings are connected by a main to the village pumphouse.

B.1.2 Source

The lake has a surface area of 20 ha (50 acres) and the ice can be up to 2.7 m (9 ft.) thick. Its drainage basin is roughly 50 ha (125 acres) and receives about 100 mm of precipitation a year. Assuming 75% of this drains into the lake, it is annually replenished by about 37.5 million L (8.25 million igal), which is more than adequate for the community's needs.

The water is considered of good quality except for a slightly high total hardness level. The following analyses were done in the Department of Transport lab on samples taken in July and August, 1977. (All values in mg/L unless otherwise indicated)

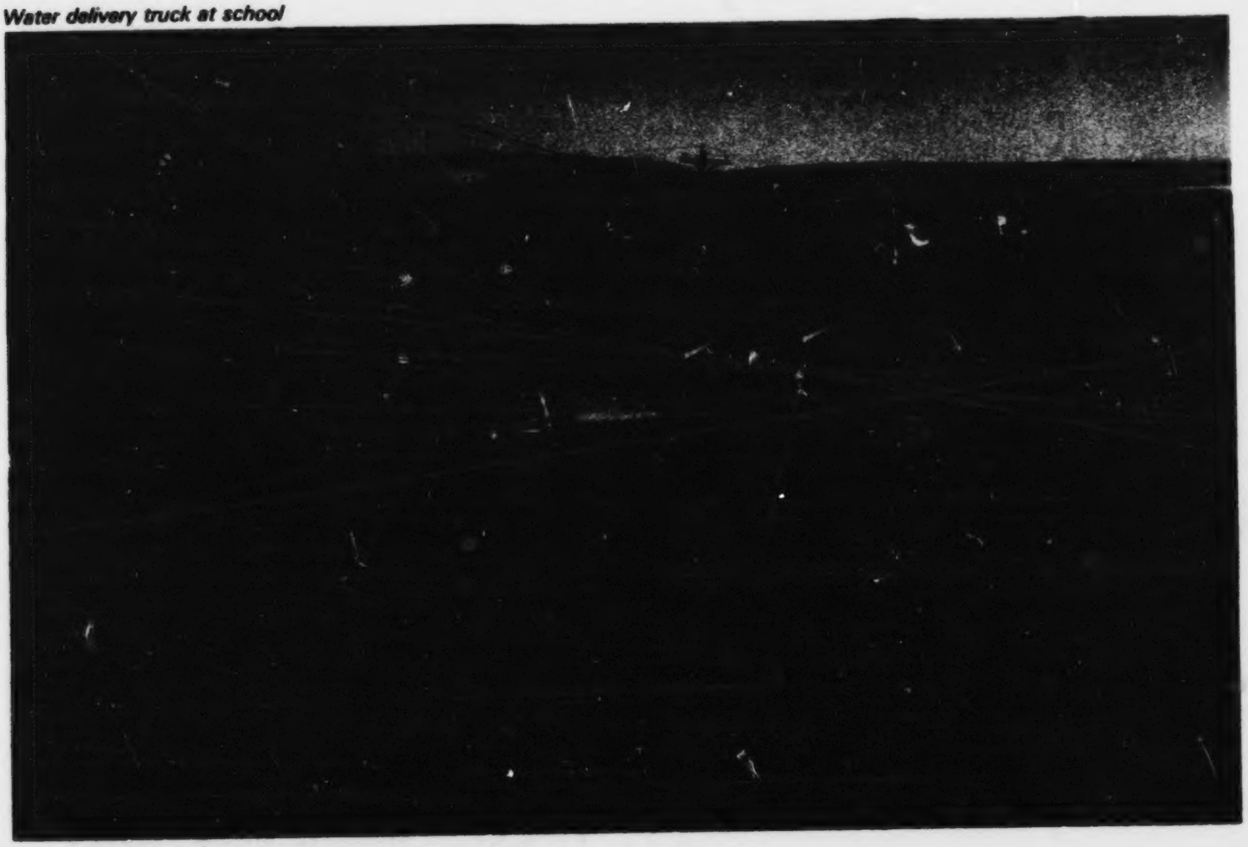
	WATER SUPPLY LAKE	
	July, 1977	August, 1977
pH	7.4	6.6
Hardness (Total) as $CaCO_3$	164	163
Sulphate	18	—
Iron	0.04	0.04
Colour	5 units	20 units
Turbidity	3.4 JTU	4.0 JTU
Ammonia Nitrogen	2.1	0.5
Total Alkalinity (as $CaCO_3$)	133	135
Calcium	44	44

B.1.3 Intake Facilities

The intake consists of 116 m of insulated and heat traced 200 mm diameter pipe. The submerged section is weighted at 4.0 - 5.0 m centers with concrete anchors. A Jacuzzi 1S-4D-S2, 1 HP submersible pump is inserted in the intake line. The intake itself is 6 to 7 m below the water surface.

The intake pipe is buried under earthfill and stone for about 45 m from shore. That portion is encased in a 375 mm, 16 gauge corrugated metal pipe.

Water delivery truck at school



An insulated 50 mm P.E. water line and 30 mm recirculation line runs from the pumphouse by the lake to the truck fill building, 305 m away.

B.1.4 Treatment and Storage
At the village pumphouse, water is chlorinated and stored in a 10.5 m³ 6.35 mm steel plate storage tank. The chlorinator is a Wallace and Tiernan 94 Series hypochlorinator.

B.1.5 Pumping Facilities
The following pumps were installed in the new facilities:

1. Type: Submersible Pump (Intake Pump)
   No.: 1
   Model: Jacuzzi 1S-4D-2S
   Capacity: 1.6 L/s @ 391 kPa TDH (21 Igpm @ 131' TDH)
2. Type: Recirculation pumps
   No.: 2 (one standby)
   Function: for lakewater recirculation for intake
   Model: Jacuzzi 5 CS - 1/2 HP
3. Type: Supply pump
   No.: 2 (one standby)
   Function: to supply water to A.E.S. facility
   Model: Jacuzzi 3 DT1-S 1/3 HP
   Capacity: 1.25 L/s@ 119 kPa TDH (16.5 Igpm @ 40' TDH)
4. Type: Recirculation pumps
   No.: 2 (one standby)
   Function: Used for water line to A.E.S. facility
   Model: Jacuzzi 3C-S1; 1/3 HP motor
5. Type: Village loading pump
   No.: 1
   Function: Used for truck filling
   Model: Jacuzzi 15DH 1-1/2-S; 1-1/2 HP motor
6. Type: Circulator pumps
   No.: 2 (one standby)
   Function: Circulate hot water from the boiler
   Model: Bell and Gossett Series PR 32 mm NPT - 1/6 HP motor

The boiler is an oil-fired Weir McLain packaged Unit No. P-566W.

B.2 Water Distribution
Insulated 38 mm water supply and 38 mm return lines run from the village pumphouse to the A.E.S. buildings.

Water is delivered in a 3400 L (750 gal) 1974 water truck to the rest of the dwellings in the community.

B.3 Sewage Collection & Waste Disposal
Bagged sewage, sewage pumpout waste and solid wastes are disposed of in an area about 1.5 km west of the community. It is a natural drainage ditch diked by gravel at the downstream end. Run-off and leachate drain through a culvert towards the ocean.

Solid waste is disposed of about 90 m from the dike and covered annually with gravel fill.

Pumpout wastes and bagged sewage deposited near the dike do not pose a health hazard at this time.

The community owns and operates a 1976, 4550 L (1000 gal) sewage pumpout truck.

B.6 Roads
The road to the water supply requires constant maintenance during the summer. It is a source of sediment input to the lake.

B.7 Surface Drainage
Drainage within the settlement is not a problem with the buildings being located on low hills.

B.8 Fire Protection
There are 7 call boxes connected to an annunciator panel. The fire vehicle is a 1972 tracked mini-pumper used by about 10 volunteer firemen.

B.9 Other Services
Other facilities at Sachs Harbour include a nursing station, an elementary school, and churches. Communication is by telephone and mail once weekly from Inuvik. Freight is shipped by barge from Hay River or by air.

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2. Project Management Division, Department of Public Works, G.N.W.T., *Sachs Harbour, Water and Sanitation Report,* December, 1977.

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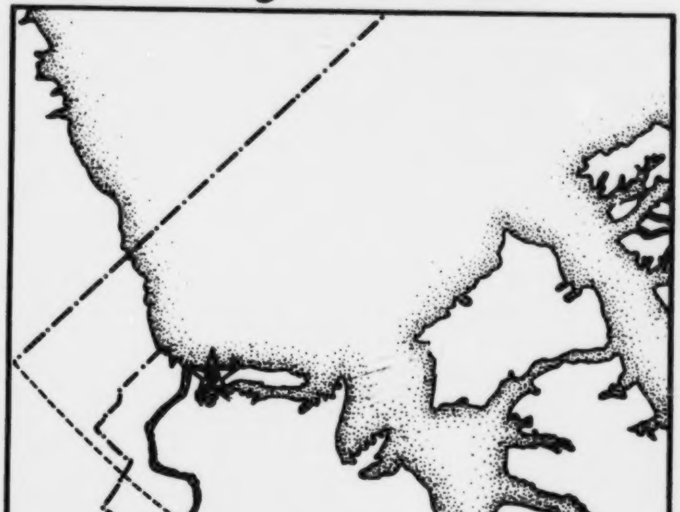
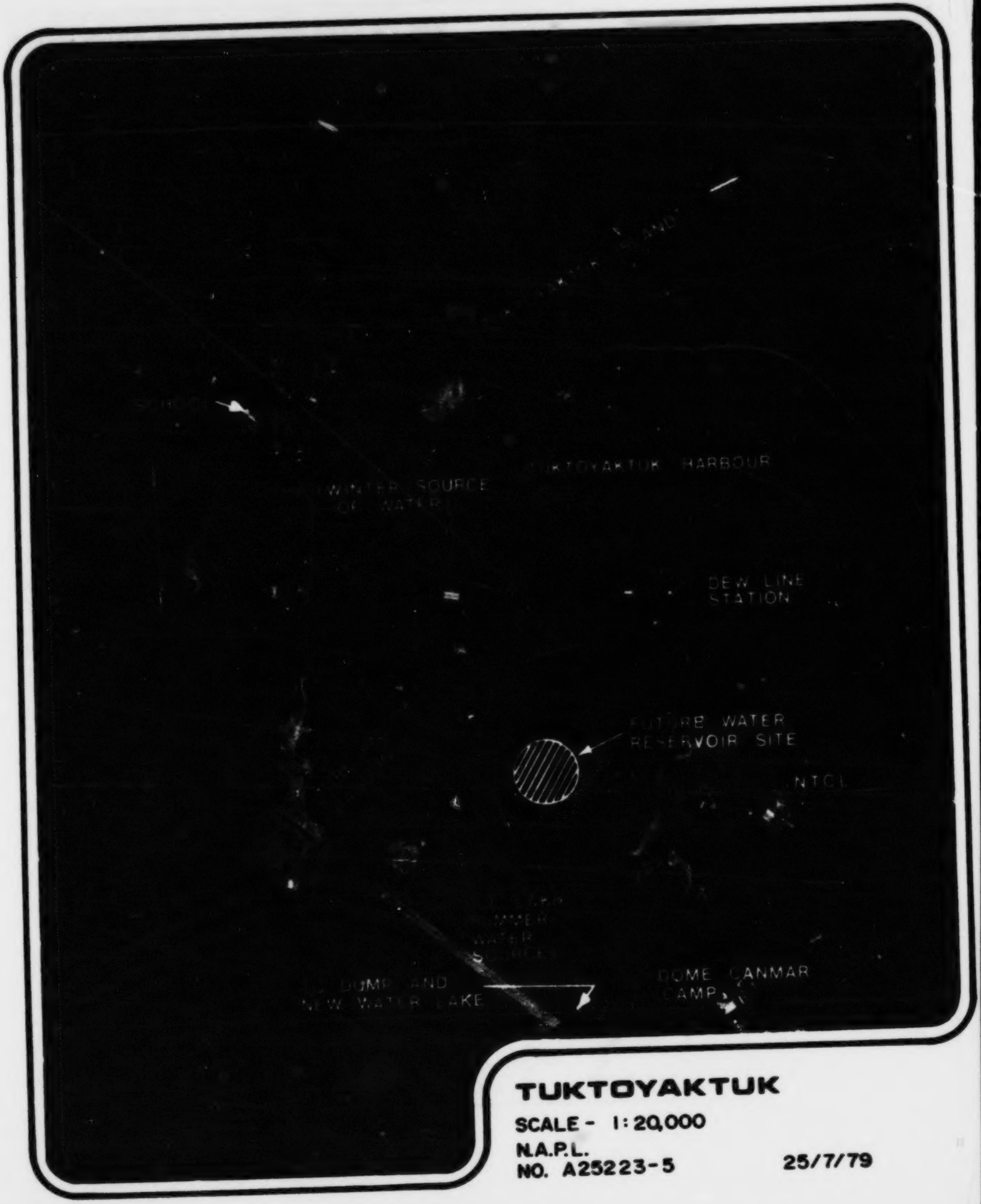
Tuktoyaktuk

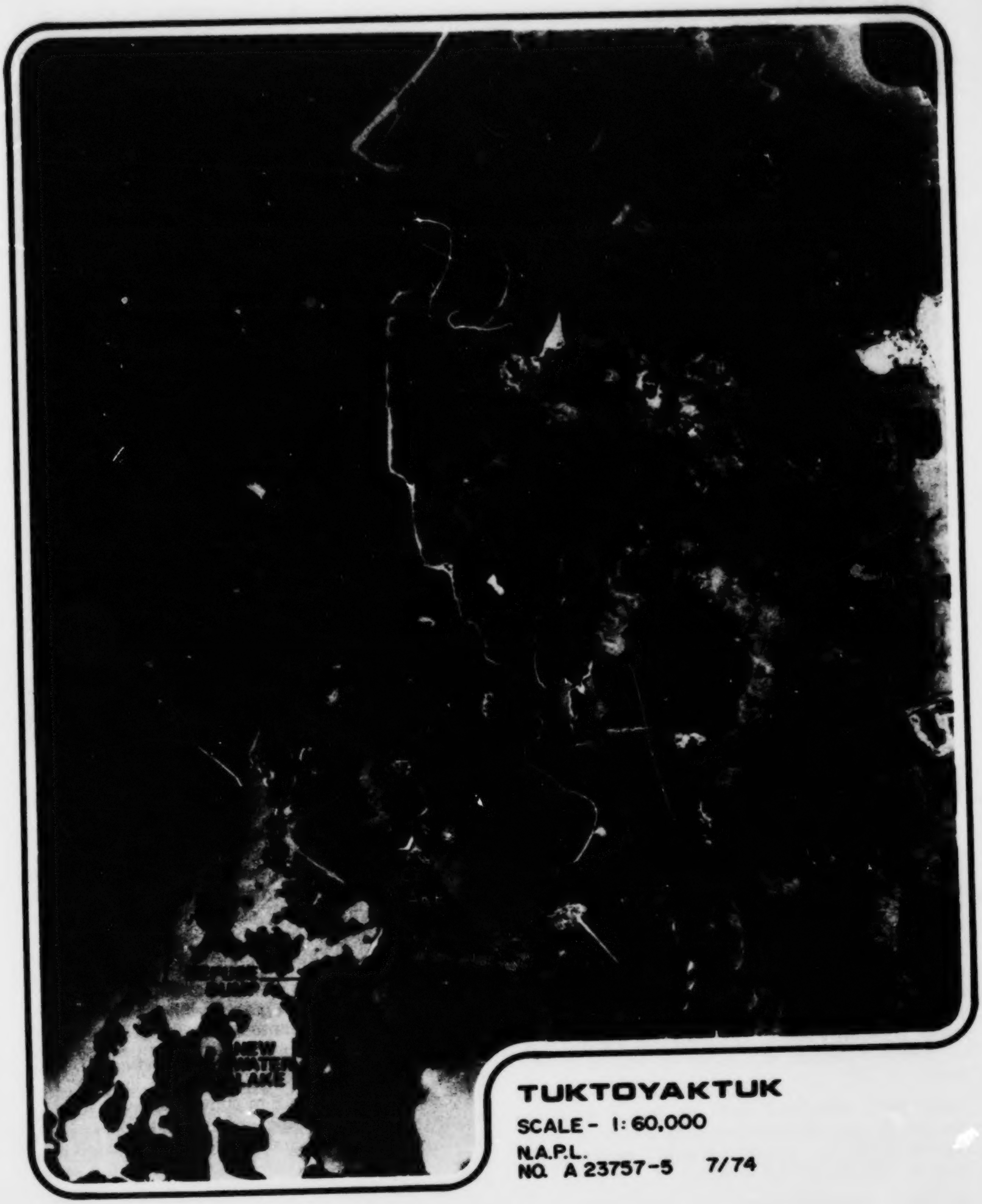



SCHOOL
TUKTOYAKTUK HARBOUR
WINTER SOURCE OF WATER
DEW LINE STATION
FUTURE WATER RESERVOIR SITE
NTCL
SUMMER WATER SOURCE
DUMP AND NEW WATER LAKE
DOME CANMAR CAMP

TUKTOYAKTUK

SCALE - 1:20,000

N.A.P.L.
NO. A25223-5 25/7/79


NEW
WATER
LAKE

TUKTOYAKTUK

SCALE - 1: 60,000

N.A.P.L.
NO. A 23757-5 7/74

A. GENERAL

A.1 Location

Tuktoyaktuk is a small community established on a fine natural harbour in Kugmallit Bay. The coordinates are 69°27'N latitude and 133°02'W longitude. This western Arctic settlement is one of the northern-most on the Canadian mainland. It is 32 km northeast of the mouth of the east channel of the Mackenzie River, 1130 air km by air northwest of Yellowknife.

A majority of the buildings are situated on a narrow peninsula with the harbour to the east. An island across the mouth of the harbour protects it from storms.

A.2 History

The name Tuktoyaktuk is an Eskimo expression meaning 'it looks like caribou'. Tuktoyaktuk was established as an alternate port to Herschel Island in 1934 when the latter lost its importance as a whaling centre. The Hudson's Bay Company finished building a store in 1937 and the Anglican and Roman Catholic Missions were founded the same year. The 1955 DEW line construction brought temporary wage employment to the community. Recent oil exploration in the Beaufort Sea has affected the local economy.

A.3 Community Information

Tuktoyaktuk achieved Hamlet status in 1970. The population is below 800 permanent residents.

POPULATION	YEAR
760	1978
747	1979
762	1980

There are seasonal fluctuations in the population related to exploration activity. The number of residents, normally 90% Inuit, increases with the influx in the summer months.

Tuktoyaktuk grew to be the largest of the western arctic coast settlements because it is used as a transfer point for goods carried by barge up the Mackenzie River to ships that serve the coast. N.T.C.L. employs some residents and others work on the DEW Line site or are employed in exploration related activities. Economic growth is related to the petroleum industry. Many Inuit trap and hunt for a living. A privately owned reindeer herd, the only one of its kind in Canada, also generates income for the Inuit.

Other than scheduled visits by barge June to September, the only other access to the hamlet is by regular air service. The gravel airstrip is 1520 m by 45 m at an elevation of 4.5 m ASL.

A.4 Geology and Terrain

The surrounding terrain consists of flat barren tundra dotted with shallow lakes. Pingos, topographical features exclusive to the Arctic, may be seen at intervals across the landscape. These round or oblong low hills range in height up to 40 m. The active layer above the permafrost is generally less than 0.5 m.

Aerial view looking south

Tuktoyaktuk Island, at the mouth of the 1 km long harbour, is about 1.5 km long and 180 m wide on average. The land is flat, consisting of glacially deposited silt, sand and gravel, with steep 10 to 15 m high banks above the sea.

The peninsula, on which a large portion of the hamlet rests, is approximately 1300 m long, 90 to 425 m wide and 1.5 to 8 m above sea level. It was formed from transported erosion material -coarse sands, silt, clay and gravel - with interbedded ice lenses. Significant erosion is occurring on the west or exposed side of the peninsula.

A.5 Vegetation

The land is covered with an organic mat of moss and peat. Local vegetation also includes grasses,

lichens, and small bushes of willow and Labrador Tea. Small flowering plants are prevalent in the warmer months.

A.6 Climate

The region has eight months of winter, one month approximately of spring and of fall, with only two months of above freezing temperatures. The ice breaks up late June and the harbour freezes again in early October. The mean winter temperature is about -29°C and the summer mean temperature is 4°C. The mean yearly temperature is -10°C. The extreme temperature range is -46°C to 27°C. The total yearly precipitation is 156.2 mm, of which 102 mm is rainfall.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Inland lakes are used for water supply from June to December. After the ice forms in the harbour, fresh water from the Mackenzie River displaces the salt water. Harbour water is then pumped from the harbour from December until break-up since the inland lakes freeze solid.

A new reservoir was constructed in 1981 and is to be recharged from an inland re-supply source. The lined earthen reservoir will be sized to provide the yearly potable water requirements for the Hamlet, Dome/Canmar base and the Dew Line Site, as well as other users in the area such as NTCL. It will have a design life of 20 years. The reservoir is intended to be recharged once per year from a suitable re-supply source using a pipeline. The new water supply system including a truck fill point and pumphouse at the reservoir is expected to be operational by the fall of 1983.

Tuk Harbour on left

B.1.2 Sources

During the summer, water is presently pumped from Ice Lake adjacent to the community or New Water Lake, which is 7 km south of the settlement. Water quality problems exist due to algae, insects, dust, silt and variable salinity. NTCL hauls water from Pikiolik Lake which is across the harbour from the hamlet and is inaccessible by road.

The Department of Indian and Northern Affairs obtained water samples in June of 1977. The results are given below: (All values in mg/L unless otherwise indicated)

	Pikiolik Lake	Ice Lake	New Water Lake
pH	7.7	8.2	8.1
Turbidity	2.2 JTU	1.7 JTU	2.0 JTU
Colour	5.0 units	5.0 units	245.0 units
Calcium (Ca)	15.3	47.5	71.5
Total Hardness ($CaCO_3$)	63.1	208	241
Total Alkalinity ($CaCO_3$)	49.7	98	126
Chloride (Cl)	17.0	260	360
Sodium (Na)	9.2	145	200
Iron (Fe)	0.36	0.09	0.12

During the winter, water is currently pumped from the harbour near the Hudsons Bay store. Water quality is generally adequate as shown by the following 1978 analysis. High salinity levels render it unsuitable for drinking after break-up. (All values in mg/L unless otherwise indicated)

	Tuktoyaktuk Harbour	
	Sample #1 May 29, 1978	Sample #2 May 28, 1978
pH	8.5	7.7
Total Dissolved Solids	488	792
Calcium (Ca)	42	45
Sodium & Potassium (Ca & K)	99	174
Chloride (Cl)	117	303
Total Alkalinity ($CaCO_3$)	-	102
Total Hardness ($CaCO_3$)	179	227
Iron (Fe)	Trace	0.80

(B.W. Brookes Engineering)

Sample #1 was taken in the harbour half way down the peninsula at the D.P.W. docks. Sample #2 was taken further down the harbour shore past the D.E.W. Line station.

B.1.3 Intake Facilities

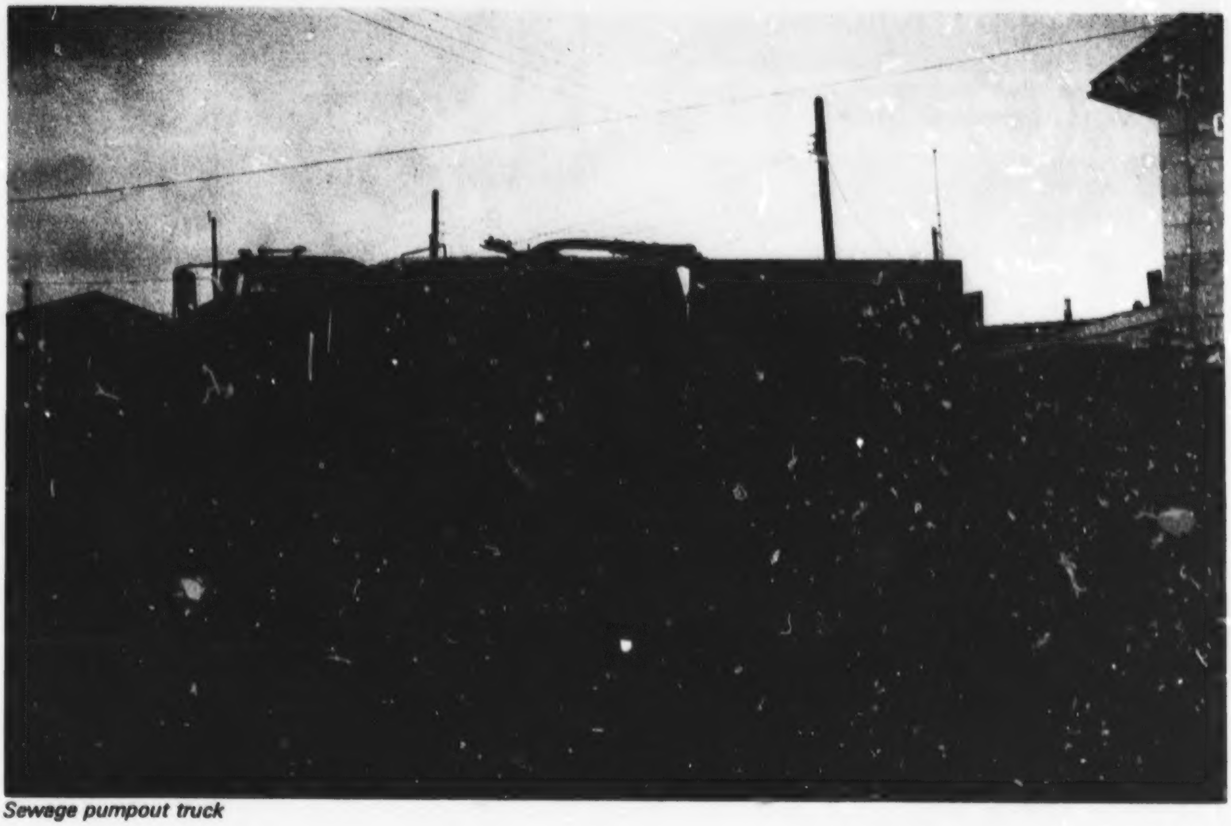
Northern Transportation Company Limited (NTCL) has an 75 mm (3") diameter aluminum summer supply line from Ice Lake to their camp.

For the Hamlet's water, the truck is driven down a 6.8 km road to New Water Lake or to nearby Ice Lake where an intake hose, the end of which is covered with wire mesh, is used to fill the tank.

B.1.4 Treatment

The water is simply screened to remove large particles and is disinfected with chlorine (household bleach) in the water truck tank.

Pingo



Sewage pumpout truck

B.2 Water Distribution

Water is distributed under private contract using a 3 ton truck with a 4550 L (1000 Igal) tank and pump mounted on it.

B.3 Sewage Collection

Approximately 60% of the community uses bagged sewage. The rest of the residents have holding tanks. These tanks are generally 2275 L (500 Igal), insulated, and located under the houses. Dwellings equipped with pressure water systems empty all wastes to the holding tanks. Other homes discharge greywater through a pipe to the ground beside the building.

Sewage is pumped out by a truck with a 6800 L (1500 Igal) tank and vacuum pump. In 1977, the Hamlet handled the contract for sewage pumpout.

Bagged sewage is collected six days per week from the side of the road in front of the homes. A new bag is left at each home in its place.

Sewage pumpout and honeybags are dumped onto sloping ground which drains to a 4 ha lagoon. The hauling distance to the disposal area for both garbage and sewage is 5.2 km.

B.4 Solid Waste

Garbage is collected six times per week concurrently with bagged sewage. The refuse is burned at the disposal site 5.2 km from the Hamlet.

B.5 Roads and Surface Drainage

The roads are generally constructed by depositing fill materials directly on the ground surface.

Surface drainage is not a problem mainly due to the fact that there is less than 200 mm of precipitation per year. Any run-off drains to the sea or low lying areas.

B.6 Fire Protection

There are 10 call boxes connected to an annunciator panel to warn of a fire. The fire truck is a 1976 standard triple combination pumper, and housed in a fire hall. Approximately 14 volunteers are on call for fire suppression.

B.7 Other Services

Tuktoyaktuk receives CBC radio from Inuvik and CBC Northern Television Service. Facilities include the following: a primary school, nursing station, Anglican, Catholic, Bahai, and Pentecostal Churches, a library, a curling rink, a five hole golf course, a community centre, two hotels, one of which is open only during the summer months, and a bank operated from Inuvik. A power line extends from Inuvik to Tuktoyaktuk providing electrical service from generation facilities owned and operated by NCPC. A local 900 KW standby generator is available for emergencies.

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4. Associated Engineering Services, *Report to Department of Public Works, Government of the N.W.T. on Tuktoyaktuk Water Supply and Waste Disposal,* July, 1974.

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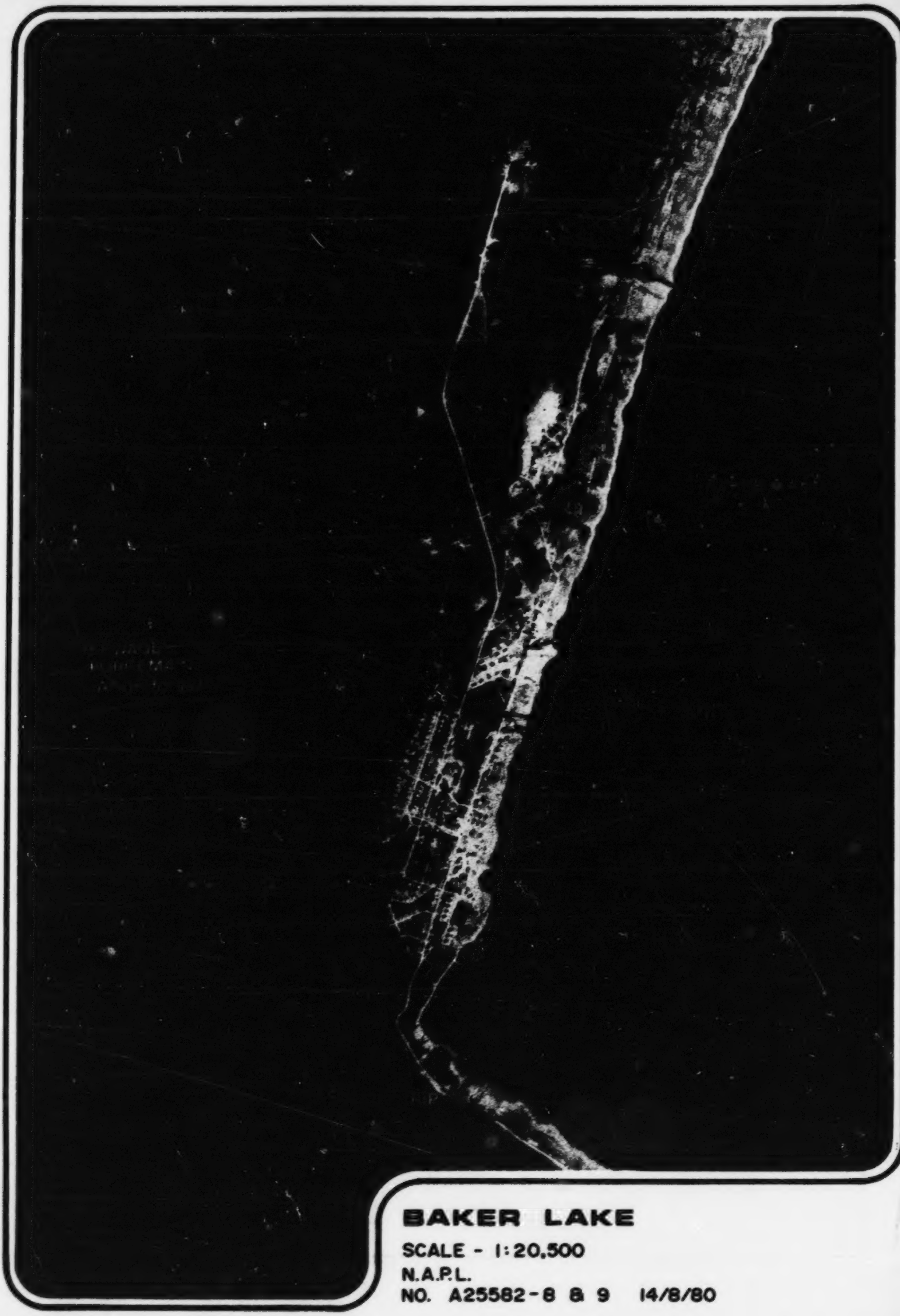
Harbour dredging

Earthen water reservoir/initial construction

KEEWATIN REGION

Baker Lake



BAKER LAKE

SCALE - 1:20,500

N.A.P.L.

NO. A25582-8 & 9 14/8/80

A. GENERAL

A.1 Location

Baker Lake is located at the northwest end of Baker Lake near the mouth of the Thelon River. It has geographical co-ordinates of 64°18'N and 96°03'W. It is 256 air km northwest of Rankin Inlet and 940 air km east of Yellowknife.

A.2 History

The settlement of Baker Lake is at the approximate geographical centre of Canada. It was named after Sir William Baker of the Hudson's Bay Company. The Inuit population are the descendents of the Copper Eskimos and are the only true Inland Inuit in the world.

A trading post was established by the Hudson's Bay Company in 1916. The Anglican Mission was built in 1926 and the Roman Catholic Mission in 1927. The R.C.M.P. appeared in 1929. The Department of Transport established a meteorological station in 1948.

A.3 Community Information

Baker Lake achieved Hamlet status on April 1, 1977. The population has remained fairly stable over the past few years as indicated by the following figures:

POPULATION	YEAR
1007	1978
1017	1979
1062	1980

The economy of the community is dependent on hunting, fishing and wage employment. The Hamlet is also renowned for the tapestry work produced there.

A 1280 m x 45 m gravel surfaced runway is located southwest of the community at an eleveation of 18 m A.S.L. A two man R.C.M.P. detachment, a nursing station and a primary school (kindergarten - grade 9) are also located in the community.

A.4 Geology and Terrain

The surface material in the immediate vicinity of the Baker Lake settlement consists of silty sand and silty clay over boulder till, beach deposits, and reworked till. The land slopes up from the beach toward a few rocky ridges. Most of these ridges are about 1 km inland.

Permafrost conditions are prevalent. The maximum active layer thickness is approximately 1.5 m.

A.5 Vegetation

Baker Lake is situated in the tundra region of the Arctic. The only vegetation includes mosses, lichens, and grasses.

A.6 Climate

Baker Lake experiences about 279 days of frost per year. The mean July high and low temperatures are 15.7°C and 5.6°C respectively. The January high and low temperatures are -30.1°C and -37.0°C respectively. Rainfall averages 124 mm and snowfall averages 889 mm per year.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.2 Source

The source of potable water is Baker Lake itself. It is a large body of water about 90 km long and 25-30 km wide. It is fed mainly by the Thelon River draining from the east and the Kazan River from the south. A chemical sample collected by Interdisciplinary Engineering in November, 1979 indicates that the water is of good quality.

Aerial view

Results are as follows: (Note: All values in mg/l unless otherwise indicated)

PARAMETER	
pH	6.5
Turbidity	2.2 NTU
Total dissolved solids	23
Total alkalinity (as $CaCO_3$)	7

A few residents who believe the Baker Lake water is unsatisfactory, haul ice and water from the Thelon River.

Hardness (as $CaCO_3$)	20
Sulphate (SO_4)	2
Chloride (Cl)	1
Fluoride (F)	.06
Cadmium (Cd)	.003

B.1.3 Intake Facilities

The original intake line consisted of 100 m of 100 mm diameter ductile iron pipe and 82 m of P.V.C. pipe which was weighted and went to a depth of 7.3 m. The P.V.C. section was removed, probably dragged away by a ship's anchor. The lost section was not replaced. Instead a wye along with an intake screen was installed on the broken end. The intake is now in 4.5 m of water.

The intake pipe contains pyrotenax heating cables for use in emergencies.

B.1.4 Pumphouse Facilities

The pumphouse which is owned and operated by the GNWT is located near the lake as shown in the aerial photo. It is an insulated steel building measuring about 5.5 m x 11 m x 4.3 m high. One room contains the pumping storage and treatment facilities while the other room is used as a vehicle storage garage.

Water enters the 4.6 m deep concrete wet well of the pumphouse through a 1.8 m diameter intake located beneath the treatment plant. The wet well is kept from freezing by pumping water through an oil fired boiler.

Two low lift centrifugal pumps are used to draw water from the wet well to the 8000 L steel storage tank.

Treatment consists of chlorination using a Wallace and Tiernan, A745 hypochlorinator. The chlorine is injected into the reservoir simultaneously with the operation of the low lift pumps.

The storage tank feeds two systems for supplying water. The first is the community water delivery vehicles. Water is pumped through a hose into the delivery vehicle by a 3 hp Monarch pump.

The other system is piped water distribution owned by M.O.T. Two Jacuzzi, 5 stage, 1-1/2 HP pumps feed water to a hydro-pneumatic tank. This system is metered.

Water intake pumphouse

B.2 Water Distribution

B.2.1 General

Two water distribution systems exist in Baker Lake. A piped system owned and operated by M.O.T. serves the nursing station, M.O.T. houses and their complex of buildings. The other is a vehicle delivery system serving the remainder of the Hamlet.

B.2.2 Piped System

The M.O.T. distribution system is heat traced with pyrotenax cable and shallow buried. Specifications are as follows:

Type: HDPE
Diameter: 75 mm
Insulation: 75 mm polyurethane foam

B.2.3 Trucked System

Water delivery service is provided by the Hamlet. There are three delivery vehicles. Two twin-tracked Bombardiers have 2275 L tanks. The wheeled vehicle is a Dodge truck with a 4550 L insulated tank mounted on it. During the winter oversize tires are mounted on the truck to help it manoeuver through the snow.

Most of the new dwellings have a 1135 L water tank. Older homes usually contain a 205 L fibreglass water container.

B.3 Sewage Collection

B.3.1 Sewage Pumpout

At present, no piped sewage collection system exists in Baker Lake. Holding tanks are pumped out three times a week by the Hamlet. A Muskeg Bombardier mounted with a 2275 L insulated tank and a 4,550 L tank mounted on a four wheel drive Dodge truck are used for pumping out the holding tanks.

Most of the newer buildings are equipped with 2275 L holding tanks while the M.O.T. houses have 4545 L tanks.

B.3.2 Bagged Sewage Pickup

Bagged sewage is placed outside on the ground by the garbage drum. These are collected by the Hamlet with a GMC truck with 205 L (45 Igal) containers in the back. Bags are collected approximately every two days.

B.4 Sewage Disposal

In 1979, a new sewage macerator/lift station and forcemain were placed into operation. The system pumped sewage from the centrally located lift station to a small lake used as a sewage lagoon 1.6 km northeast of the community.

The lift station is a pit type macerator station designed to accept piped, trucked and bagged sewage. The macerator is a Chittenden-Howard Type FS006 with a 5.5 KW rating.

Specifications for the pipe are as follows:

Type:	HDPE
Diameter:	90 mm
Insulation:	Urethane

The system was designed to pump sewage along the forcemain to a high point about 1200 m behind the community where it would then flow by gravity to the lake.

The insulated forcemain is buried in town but runs above ground in the tundra portion. Initially, a heat tracing system was installed which consisted of a heat trace cable fitted within a 19 mm diameter HDPE pipe which in turn ran inside the forcemain. Cyclic fluid pressures within the pipe due to on/off pump operation caused failure of the 19 mm conduit. This conduit has now been removed and the bare heat tracing was re-installed.

The treatment system was designed to provide sewage treatment prior to the effluent ultimately being discharged to Baker Lake.

The sewage flows to Finger Lake, eventually discharging into Airplane Lake and finally into Baker Lake. The total theoretical retention time for sewage passing through this system is about 1891 days. (see aerial photo)

This system has been inoperative since the winter of 1979-80 when the transmission main froze and broke. In addition, there have been some difficulties with the macerator not chopping the sewage bags as intended.

Presently sewage pumpout and bagged sewage is being dumped into Airplane Lake.

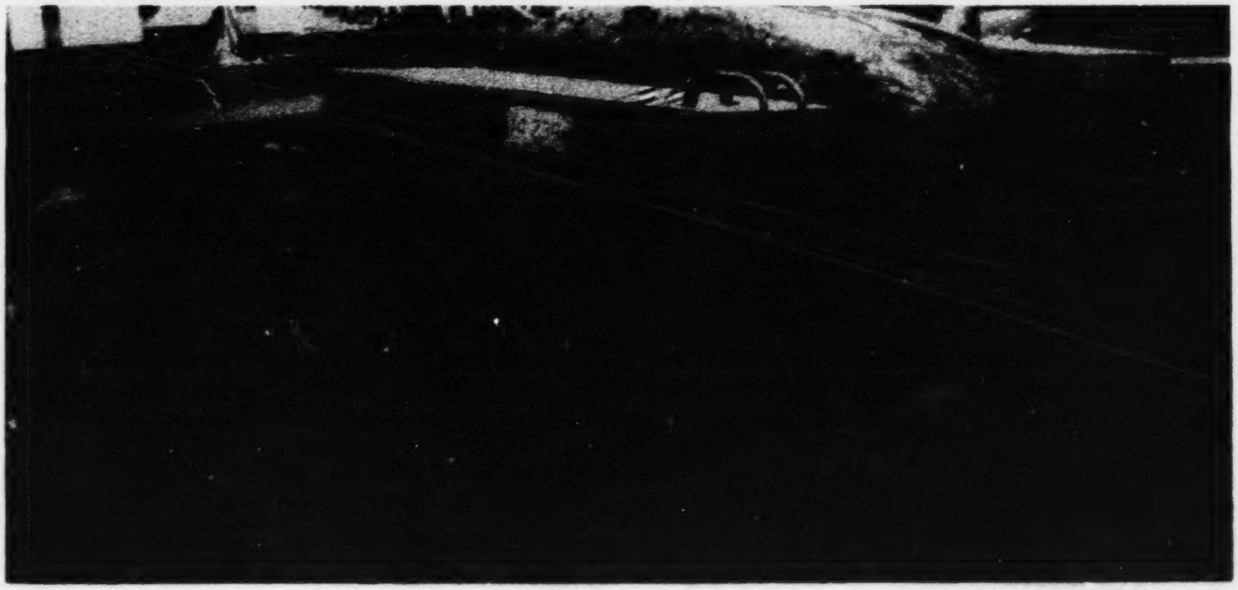
Greywater is discharged outside homes onto the ground.

The entire question of sewage disposal in Baker Lake has been reevaluated in light of the failure and subsequent abandonment of the forcemain. Meetings held with the Hamlet Council in Baker Lake during the early months of 1981 reaffirmed the use of the Finger Lake area as a Sewage Disposal Site. In lieu of transporting the sewage to the Finger Lake area by force main, a totally trucked system was decided upon. During the summer of 1981 approximately 1.5 km of all season road was constructed from the existing community road net work to the Finger Lake area. Additional future phases of the Sewage Disposal System to be constructed in Baker Lake include the construction of a discharge facility at the Finger Lake site and construction of a community pumpout collection station.

B.5 Solid Waste

Garbage is deposited in 205 L drums adjacent to the

Sewage pumpout truck



roads. It is collected by the Hamlet with a 3/4 ton GMC stake truck.

Garbage is currently dumped at the disposal grounds about 3 km east of the Hamlet. Most paper is burned in the drums prior to collection.

Ultimately all solid waste will be disposed of north of the community adjacent to the Finger Lake Sewage Disposal Site.

The existing solid waste facility at Airplane Lake will eventually be reclaimed.

B.6 Roads and Drainage

Road maintenance is an annual necessity since the spring thaw runoff washes out several roads each spring.

During the winter severe snow drifting occurs in the Hamlet and often causes road blockage problems.

The heavy snow accumulation, the steep grade of the settlement and the quick thawing contribute to the damaging effects of runoff water. Drainage paths vary yearly and culverts become frozen or blocked due to icing each spring.

B.8 Fire Protection

Fire protection in Baker Lake consists of the following:

- one (1) 1978 model wheeled triple combination pumper truck capable of pumping over 34 L/s; 18 volunteers and a fire hall.

B.9 Other Services

Telephone service is operated by Bell Canada. Radio and TV are also available. Mail service is three times a week. NCPC provides power through diesel generation facilities.

INFORMATION SOURCES

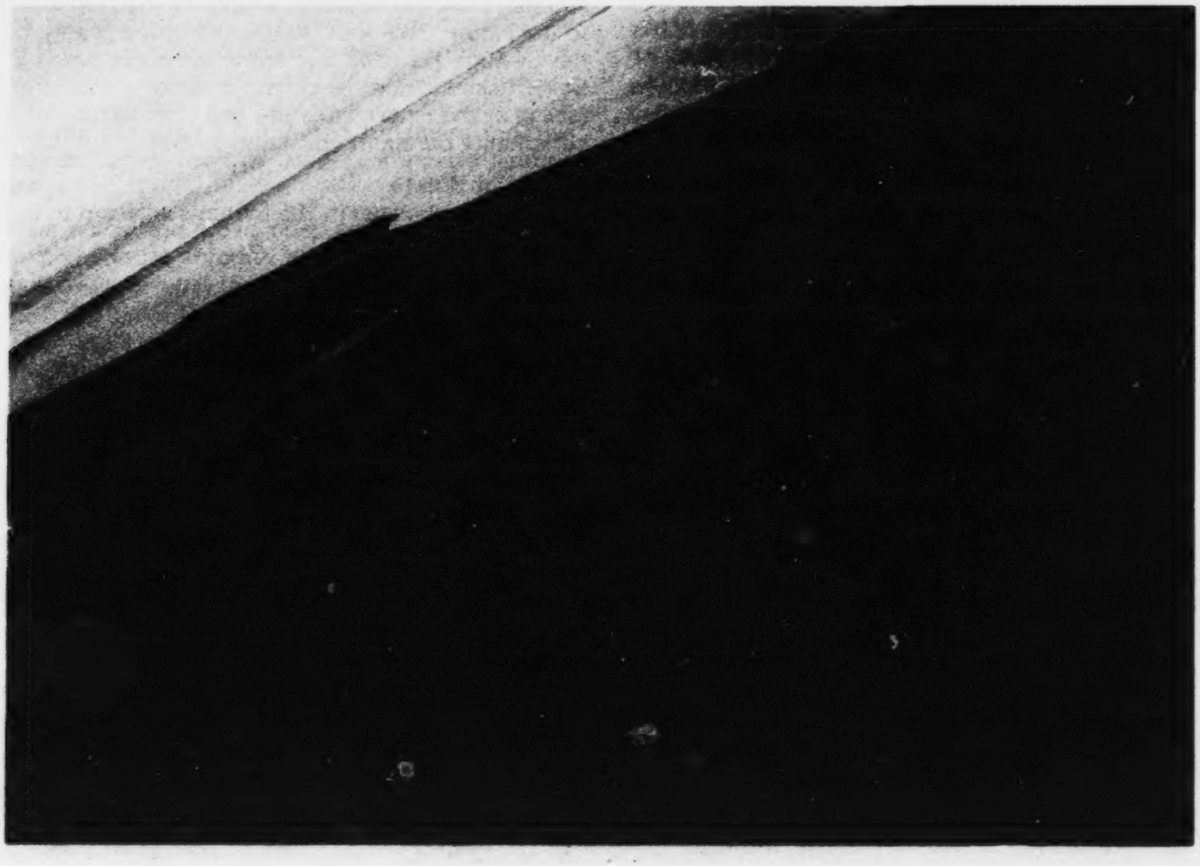
1. Government of the Northwest Territories, *Assessment of the Baker Lake Sewage Macerator/Forcemain,* March, 1980.

2. Government of the Northwest Territories, *Sewage Disposal Report, Baker Lake, N.W.T.,* January, 1980.

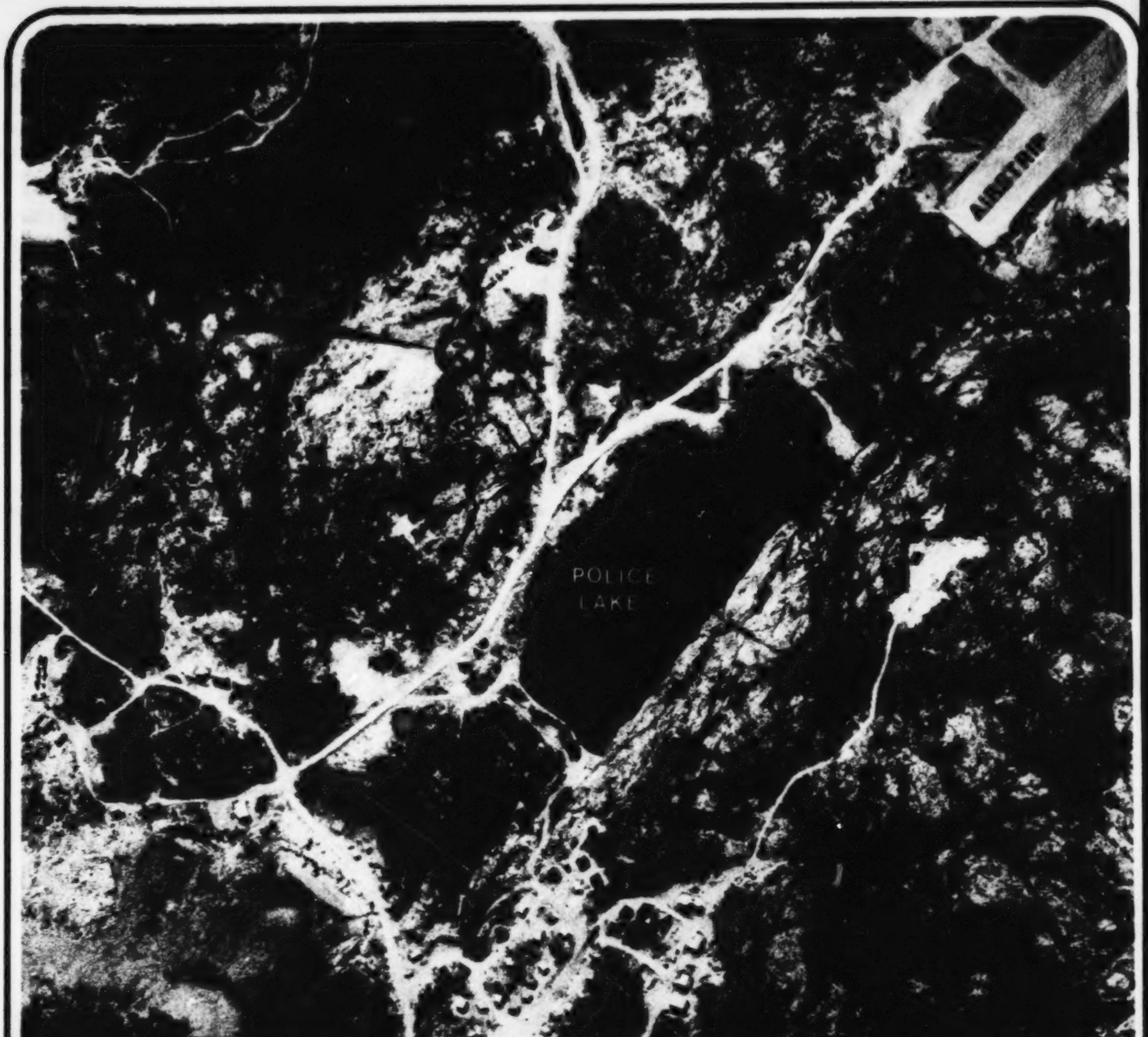
3. Interdisciplinary Engineering Company, *Baker Lake Community Planning Study,* January, 1980.

4. M.W. Scott, G.W. Heinke, University of Toronto, *Macerator Study for the Government of the Northwest Territories.* September, 1980.

Road to Finger Lake area constructed during 1981.



Chesterfield Inlet


AIRSTRIP
POLICE LAKE
HOTEL
SCHOOL
SPURRELL HARBOUR
MISSION LAKE

CHESTERFIELD INLET

SCALE - 1:7,500

N.A.P.L.
NO. A25027-004 & 005 27/7/78

Aerial view

A. GENERAL

A.1 Location

Chesterfield Inlet is located on a small bay on the south shore of Chesterfield Inlet, a 240 km long arm of the sea on the westside of Hudson's Bay. The geographical co-ordinates are 63°21′ north latitude and 90°42′ west longitude. The community is 101 km northeast of Rankin Inlet and 1147 km by air east of Yellowknife.

A.2 History

Chesterfield Inlet was a focus for Inuit who hunted seal in the spring and early summer. Sir Thomas Button in the 'Discovery' reached Chesterfield Inlet from England in 1612 - 1613. The Hudson's Bay Company and the Roman Catholic Mission were established in 1912. A hospital was built in 1930. The Mission opened a school in 1951.

A.3 Community Information

The population of this community numbered 275 in 1980. The figures for the two previous years, 1979 and 1978, were respectively 281 and 291 persons. The community is at least 90% Inuit.

The settlement has a hospital, primary school, church, community center and store. The residents derive income from hunting, some commercial fishing, trapping and carving.

Access is by barge (NTCL) from Churchill or by air. The gravel airstip is 914 m by 30 m and located northwest of the settlement.

A.4 Geology and Terrain

Development is restricted to a narrow coastal strip due to the presence of rock ridges and lakes inland. Rock outcrop, local pond areas, and variable permafrost conditions impose further restrictions within the settlement.

The surface material within the developed area consists of sand and gravelly beach deposits with scattered boulders, sections of muskeg, and bare rock. The bedrock is Precambrian granite and gneiss.

A.5 Vegetation

The vegetation is typical of the Arctic barren lands. Mosses, grasses, and lichens are common.

A.6 Climate

Chesterfield Inlet has an average of 90 frost free days per year. The average daily temperatures in January and July are respectively -31.8°C and 8.7°C. The average annual rainfall amounts to 149 mm. The average yearly snowfall is 1128 mm. Prevailing winds are northerly at 20.9 km/h.

B. MUNICIPAL SERVICES

B.1 Water Supply

The water source is Fish Lake located about 4 km west of the community, accessible by road. Water is picked up at the lake by truck and delivered to the community.

Water delivery

B.2 Sewage Facilities

The buildings with pressure systems including the school, hostel and nursing station, have sewage pumpout tanks. All others use bagged sewage facilities. The bags are trucked to the garbage disposal site. The settlement handles the sewage collection contract. In 1977-78, 54 units were serviced three times per week.

B.3 Solid Waste

Garbage is collected under contract by the council once per week and disposed of approximately 2.4 km northwest of the community.

B.4 Roads and Surface Drainage

Roads are gravel surfaced and drainage does not pose any serious problems due to the granular nature of the soils in the community.

B.5 Fire Protection

The community has a mini pumper that is stored in a small fire hall. Call boxes are connected to a siren.

B.6 Other Services

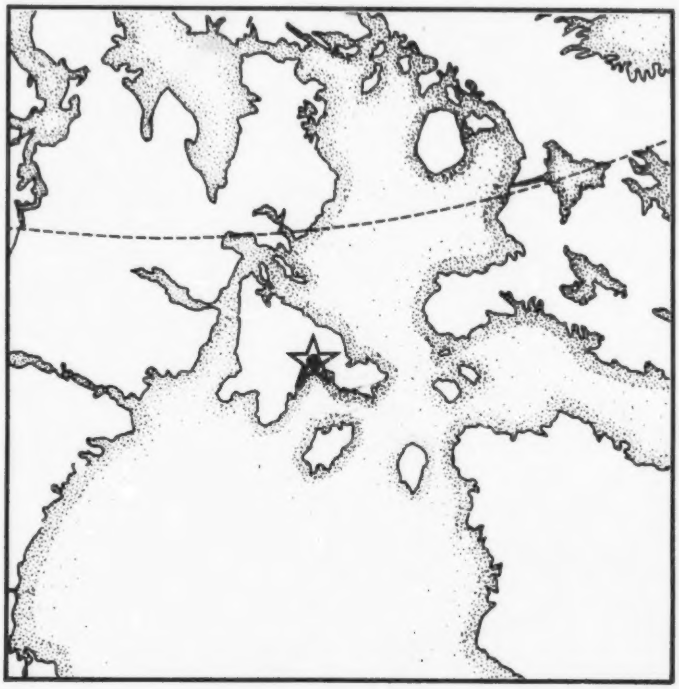
Chesterfield has telephone and radio service. Mail is delivered twice weekly. NCPC provides power with diesel generation facilities.

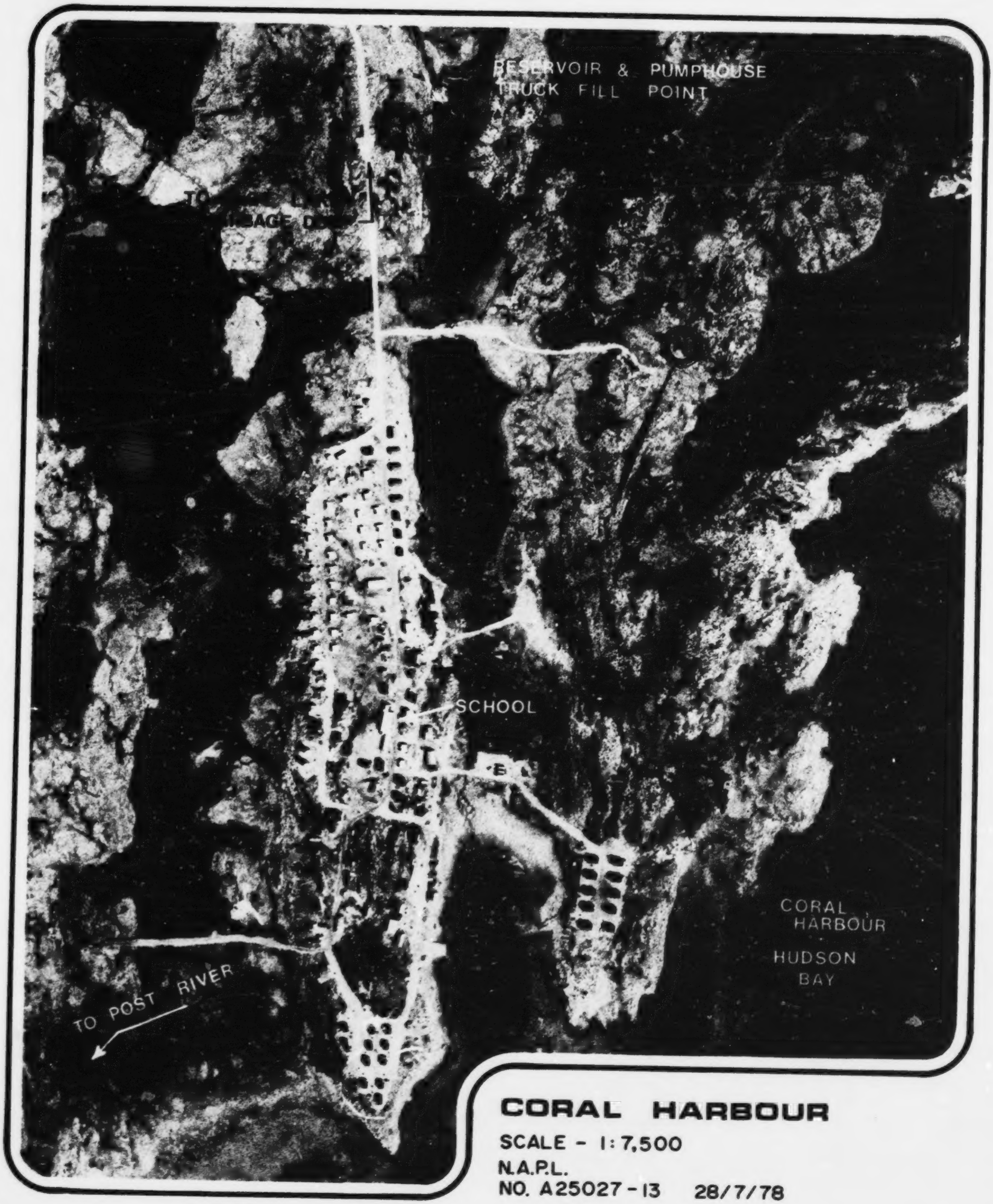
INFORMATION SOURCES

Neil Bryant, Head Fort Smith, Keewetin & Baffin Districts, Water Resources, G.N.W.T., *Report on Settlement of Chesterfield Inlet,* visit of June 18-22, 1979.

Underwood McLellan & Associates Ltd., *Planning Study Report for Chesterfield Inlet, N.W.T.,* August, 1967.

Coral Harbour




RESERVOIR & PUMPHOUSE
TRUCK FILL POINT
TO
BAGE D
SCHOOL
CORAL HARBOUR
HUDSON BAY
TO POST RIVER

CORAL HARBOUR

SCALE - 1: 7,500
N.A.P.L.
NO. A25027-13 28/7/78

A. GENERAL

A.1 Location

Coral Harbour is located on the southern end of Southampton Island at South Bay in Hudson Bay. It has the geographical co-ordinates 64°08'N and 83°10'W. It is 720 air km west of Frobisher Bay and 1560 air km northeast of Yellowknife.

A.2 History

Sir Thomas Button was the first white man to see Southampton Island on his 1612 exploration voyage. The settlement was first established by the Hudson's Bay Company, who opened a post in 1925.

During World War II, an airfield was opened by the R.C.A.F. and the U.S.A.F. 15 km from the present community. The first nursing station was established in 1963.

A.3 Community Information

Coral Harbour achieved Hamlet status on April 1, 1972. Over the past few years, the population has stayed fairly stable as indicated by the following figures:

POPULATION	YEAR
414	1978
414	1979
425	1980

The economy of the community is based on wage employment provided by the government as well as hunting and fishing.

Community services include a primary school, two churches and a community centre.

An 1830 m x 60 m gravel surfaced airstrip is located west of the community at an elevation of 64 m A.S.L.

A.4 Geology and Terrain

The area around Coral Harbour is characterized by linear bedrock ridges traversing the site in an approximate north-south direction, and spaced about 400 m apart. The hamlet is located on the end of one such ridge.

Where the rock is not exposed at the surface in the troughs, the ground is usually covered with a thin veneer of brown fibrous peat.

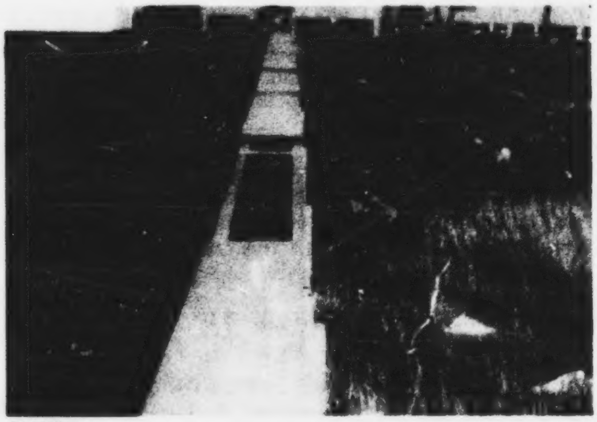
The troughs are generally filled in with fine grained sediments. The active layer varies up to 2 m below the surface during the late summer months.

A.5 Vegetation

Typical Arctic vegetation consisting of mosses and lichens are present throughout the region.

A.6 Climate

The mean high and low temperatures in July are 12°C and 4°C respectively. The January mean high and low temperatures are -26°C and -35°C respectively. Precipitation consists of 122 mm of rain and



Utilidor

1125 mm of snow. The prevailing northerly winds have an average velocity of about 25 km/hour.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Source

The present water source for Coral Harbour during the summer and fall months is the Post River which is located about 1 km west of the community. This water course is fast flowing and of adequate capacity and quality for the Hamlet.

A typical water chemical analysis is as follows: (NOTE: All values in mg/l unless otherwise indicated)

PARAMETER	
pH	7.8
Fluoride (F)	<0.1
Chromium (Cr)	<0.01
Lead (Pb)	<0.02
Mercury (Hg)	0.10
Total Hardness (as $CaCO_3$)	19.7
Total Alkalinity (as $CaCO_3$)	19.8
Total dissolved solids	57.8
Turbidity	1.0 JTU
Colour	<5 Colour Units
Nitrates as N	<10.0

During the winter, when the river cannot be used directly due to freeze-up, D.O.T. Lake 6.6 km north of the community is used. However, there are a number of problems with the use of this source, some of which are as follows:

- weather conditions often cause closure of the road to the lake;

- the quality of the water beneath the ice deteriorates as the winter progresses; and

- in the spring unsafe ice conditions prohibit its use.

In addition, during spring runoff, the river cannot be used due to high silt loads and road washouts often restrict its use further.

Accordingly, it is planned to overcome these problems by constructing a reservoir and trunk fill system with re-supply from the Post River.

B.1.2 Reservoir System

In 1980, construction was completed on a 45 m x 70 m x 11 m deep reservoir located north of the Hamlet as shown on the aerial photo. The reservoir has a useable storage capacity of 25,200 m³. It is designed to meet the projected demand for 1998 at 600 cubic metres per week giving 42 weeks storage. It is assumed that at least 10 weeks of good weather will be available each summer when refilling will occur. The reservoir was blasted out of solid rock. An intake and truck fill station is planned for construction at the reservoir site as the next phase of work. In 1980 a temporary fill line was installed to pump water from the adjacent lake into the reservoir.

B.1.3 Reservoir Refill System

The present plans are to construct a permanent supply line from the Post River to fill the reservoir each summer. This line will be 1500 m in length and consist of Series 100 HDPE, 150 mm in diameter. The pipe will be laid on the ground with butt face welded joints as well as flanges approximately every 150 m to enable the pipe to be dis-assembled for draining. A diesel driven, skid mounted portable pumping system will be used at the Post River.

Sewage pumpout truck

B.2 Water Distribution

A 4550 L water truck is used to deliver water to the residents per day, 6 days a week. The older homes have 200 L water storage containers while most which have running water contain 1100 L tanks. The nursing station, school, hotel, and government staff quarters contain larger tanks ranging from 1300 L to 4500 L in capacity.

B.3 Sewage Collection and Disposal

Sewage collection is carried out by means of pumpout trucks and bagged sewage pick-up. There are about 75 homes in the community of which approximately 34 are equipped with interior plumbing and sewage pumpout tanks. The remaining homes have bucket toilets. Both sewage pumpout and bagged sewage are deposited at a disposal site located about 5.5 km east of the community.

B.4 Garbage Collection and Disposal

Garbage is collected on a regular basis and disposed of at the same site as the bagged sewage.

B.5 Fire Protection

Fire protection in Coral Harbour consists of the following:

- call boxes throughout the community directly connected to a siren
- a 10 person volunteer fire brigade.

B.6 Other Services

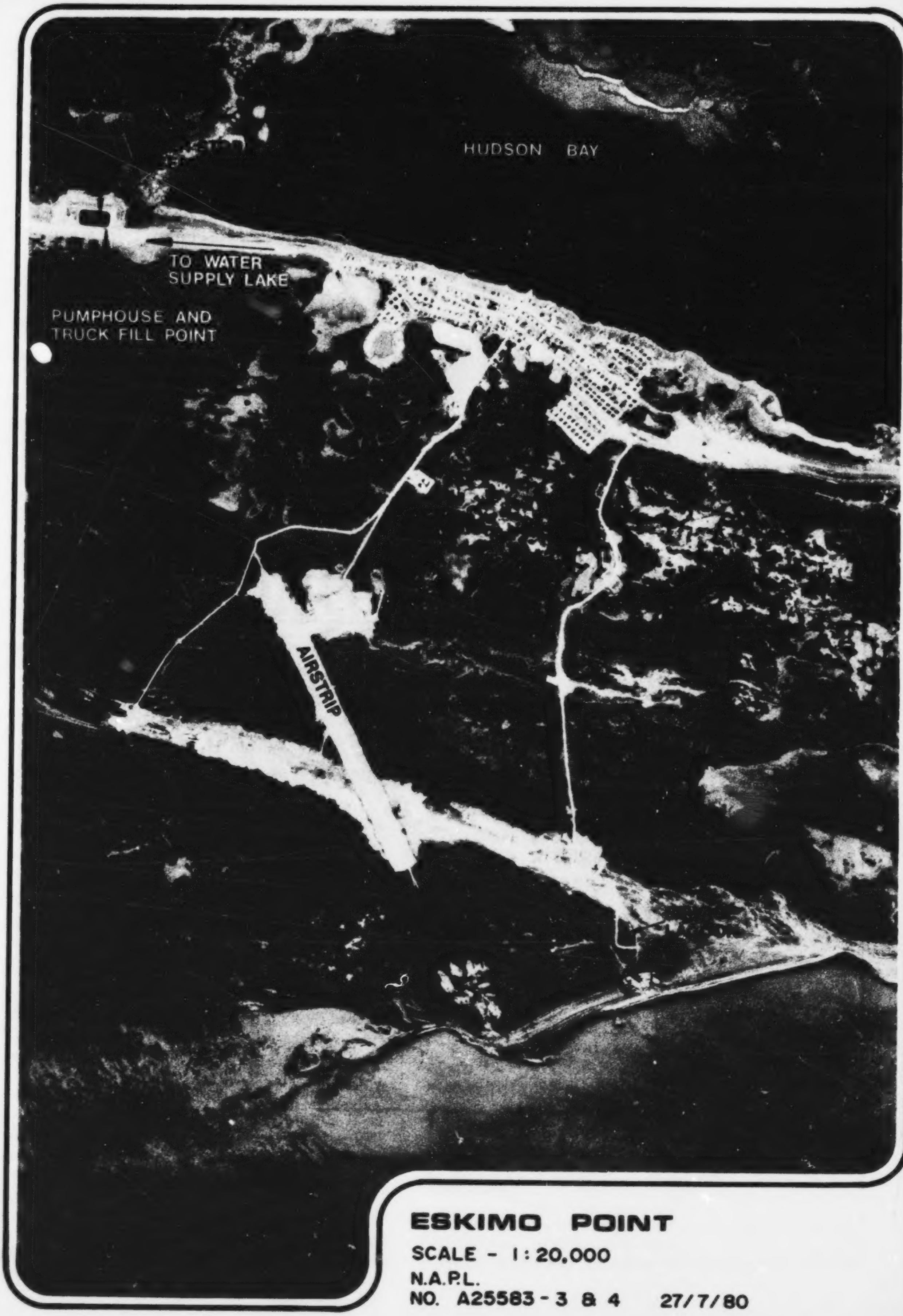
Other services include telephone by Bell and weekly postal service. NCPC provides power for the community with diesel generation facilities.

INFORMATION SOURCES

1. Thurber Consultants Ltd., *Water Supply System, Coral Harbour, N.W.T.,* Design Brief, September, 1979.

2. Government of the Northwest Territories, DDW *'Preliminary Engineering Study, Water Supply System, Coral Harbour N.W.T.'* August, 1978.

Eskimo Point


HUDSON BAY
TO WATER SUPPLY LAKE
PUMPHOUSE AND TRUCK FILL POINT
AIRSTRIP

ESKIMO POINT

SCALE - 1:20,000
N.A.P.L.
NO. A25583 - 3 & 4 27/7/80

Aerial view

A. GENERAL

A.1 Location

The community of Eskimo Point is situated on the west shore of Hudson's Bay at 61°05'N and 94°00'W about 265 air km north of Churchill, Manitoba. It is 240 air km northwest of Rankin Inlet and 1080 air km east of Yellowknife.

A.2 History

Eskimo Point has been a summer camp for inland people for centuries. A permanent Hudson's Bay post was built in 1921. In 1924 the Roman Catholic Mission was established and the Anglican Mission was founded in 1926. A school was opened in the community in 1959.

A.3 Community Information

Eskimo Point achieved Hamlet status on December 1, 1977. Its population has been gradually increasing, as indicated by the following figures:

POPULATION	YEAR
960	1978
980	1979
994	1980

Eskimo Point has the largest number of small local businesses in the Keewatin. Cash income to residents is provided through the sale of arts and crafts. Hunting and trapping remains an important factor in the economy. Potential exists with future development of inland fishing lodges and other local tourism resources. Eskimo Point is a cohesive and proud community.

Community services include two R.C.M.P. constables, a nursing station, a school (Kindergarten -Grade 9) and an Anglican Mission. A 1200 m x 30 m gravel surfaced runway is located south of the settlement at an elevation of 9.8 m A.S.L.

A.4 Geology and Terrain

Eskimo Point is located on a low lying peninsula that gradually dips east into Hudson Bay. About one third of the peninsula's surface is covered by shallow lakes and ponds.

The mainland is in the Hudson Bay lowland physiographic region, characterized by low topographic variation, occasional bedrock outcrops, and a thick mantle of glacial and glacio-fluvial debris. The most predominant features on the peninsula are three eskers. The active layer of permafrost varies between 0.5 m and 3 m.

A.5 Vegetation

Vegetation consists of mosses and lichens growing on rocky outcrops and hardy grasses growing in more sheltered areas. Sage marshes grow in swampy areas.

A.6 Climate

The July mean high and low temperatures are 13.1°C and 4.5°C respectively, while the January mean high and low temperatures are -27.9°C and -35.2°C respectively. Average yearly precipitation consists of 1181 mm snowfall and 160 mm of rain. The prevailing winds are northerly at about 20 km/hr.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 General

Prior to the construction of the present water storage reservoir, water was drawn from a shallow lake adjacent to the settlement. The maximum depth of the lake is 0.8 m and the lake freezes to the bottom during winter. An earth fill reservoir adjacent to the lake was filled every fall to provide water through the winter months. Due to the poor quality of this water many residents obtained drinking water by cutting ice in winter.

A new water source re-supply and reservoir system was established for use by the community in 1978.

B.1.2 Source

The present source of fresh water is a lake situated 3.2 km west of the community and about 2 km west of the present reservoir (see aerial photo). A typical chemical analysis of the water supply lake is as follows: (NOTE: All values in mg/l unless otherwise indicated)

PARAMETER	
pH	7.50
Turbidity	2.40 JTU
Colour (Pt - C) Scale)	10
Hardness ($CaCO_3$)	38.7
Chlorides (C1)	17.1
Sulphates (SO_4)	< 2.0
Nitrates (NO_3)	< 0.1
Phosphates (PO_4)	0.45
Fluoride (F)	0.15
Iron (Fe)	< 0.03
Total Suspended Solids	8.8

(Water Quality data obtained from Information Source No. 2)

B.1.3 Re-supply System

During the summer the reservoir is filled using a portable pumping and piping system. The 150 mm diameter polyethylene pipe has a total length of 2135 m. The pipe is supplied in 9 m sections with victaulic couplings. The pump and motor are mounted on a rubber tired trailer. It is assembled and laid on the ground surface each summer to refill the reservoir. This takes approximately 2-1/2 weeks to complete.

Storage reservoir

Specifications for the intake pump used to fill the reservoir are as follows:

Type:	Gorman Rupp Self Priming Centrifugal pump
Capacity:	26.5 L/s (350 IGPM)
Motor:	Wisconsin four-cylinder heavy duty air cooled engine

B.1.4 Storage Reservoir

The reservoir which is located beside the old airstrip is constructed of earth dikes above the original ground surface (see aerial photo). It is lined with a CPE liner to prevent seepage and was designed for a usable storage volume of 9,000,000 L below ice cover.

B.1.5 Intake/Truck Fill Pumphouse

A prefabricated intake and truck fill point pumphouse facility is located at the edge of the reservoir. A flexible hose with gasoline type nozzle which is accessible outside the pumphouse building, is used to fill water tanks. A key is required to operate the system.

A submersible pump is installed in a sloped intake extended into the reservoir.

Chlorination is provided in the intake pumphouse prior to filling water trucks. An automatic hypochlorinator is used for this purpose.

B.2 Water Distribution

The community is served by a 4550 L wheeled tank truck. The truck contains a 50 mm rubber hose on spring reel, a gasoline style nozzle on the hose and a meter. Water delivery is handled by the Hamlet Council. The aluminum tanks used in the homes through most of the community hold about 910 L.

Intake pump at Water Lake

B.3 Sewage Collection

About 50 homes have pump out tanks. A 6820 L (1500 Igal) wheeled truck is used to collect the liquid sewage. A Gorman Rupp self priming pump with 65 mm suction and discharge, powered by a 25 HP gasoline engine, is mounted on the truck. Collection is handled by the Hamlet Council.

Bagged sewage is placed outside the homes beside the garbage barrels. The bags are picked up at the same time as the solid waste using a Ford 3/4 ton pick-up truck.

B.4 Sewage Disposal

Liquid sewage is disposed of in a lagoon located approximately 2.5 km southeast of Eskimo Point. The lagoon is 3 m to 3.5 m deep.

Bagged sewage is deposited at a disposal site which is located near the sewage lagoon.

The site occupies a south facing slope of the south esker, at a point where it has been broadened by a bedrock outcrop, and further reworked and broadened by wave action. It is readily accessible, and has good natural drainage to the ocean. There is a good supply of cover material nearby.

B.5 Solid Wastes

Garbage from homes is placed in 205 L (45 Igal) drums near the road. Householders burn the combustibles to reduce the volume and to reduce scattering of material by wind. Garbage is collected along with the bagged sewage.

Garbage is dumped with the bagged sewage at a location near the sewage lagoon. As much as possible is burned and the residue is bulldozed into a specific location.

B.6 Roads

The only roads are the local roads and the ones linking the airport and sewage lagoon with the community. There are adequate gravel sources in the nearby eskers for road construction and maintenance.

B.7 Surface Drainage

In this locality, surface drainage is generally poor and hindered by the presence of permafrost.

B.8 Fire Protection

Fire protection in Eskimo Point consists of the following:

- call boxes connected to an annunciator panel in a central building; the annunciator panel indicates which call box was activated and also sounds the alarm;
- a 1977 wheeled Mini-pumper capable of pumping 11-34 L/s (150 - 450 IGPM); and
- a 12 member volunteer fire brigade.

B.9 Other Services

Other services include mail service three times a week, and Bell telephone and C.B.C. T.V. service via Anik Satellite. Power is generated using diesel powered facilities owned and operated by NCPC.

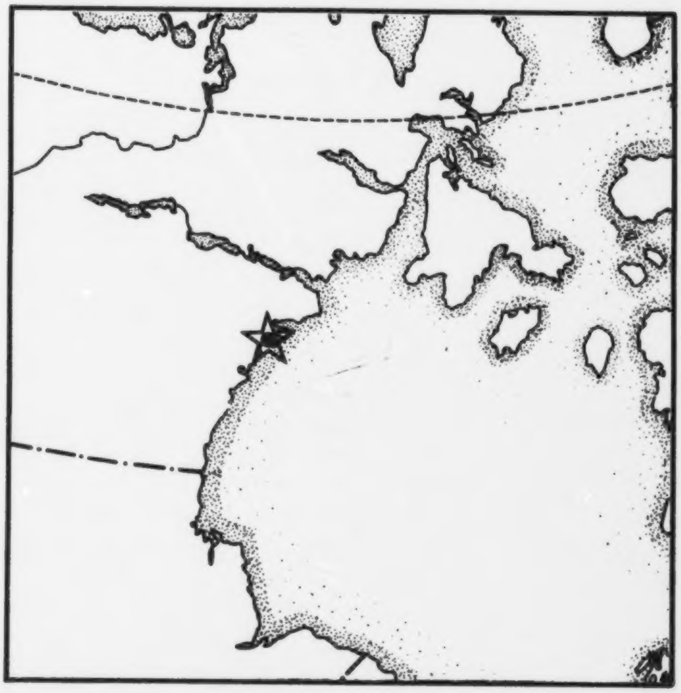
INFORMATION SOURCES

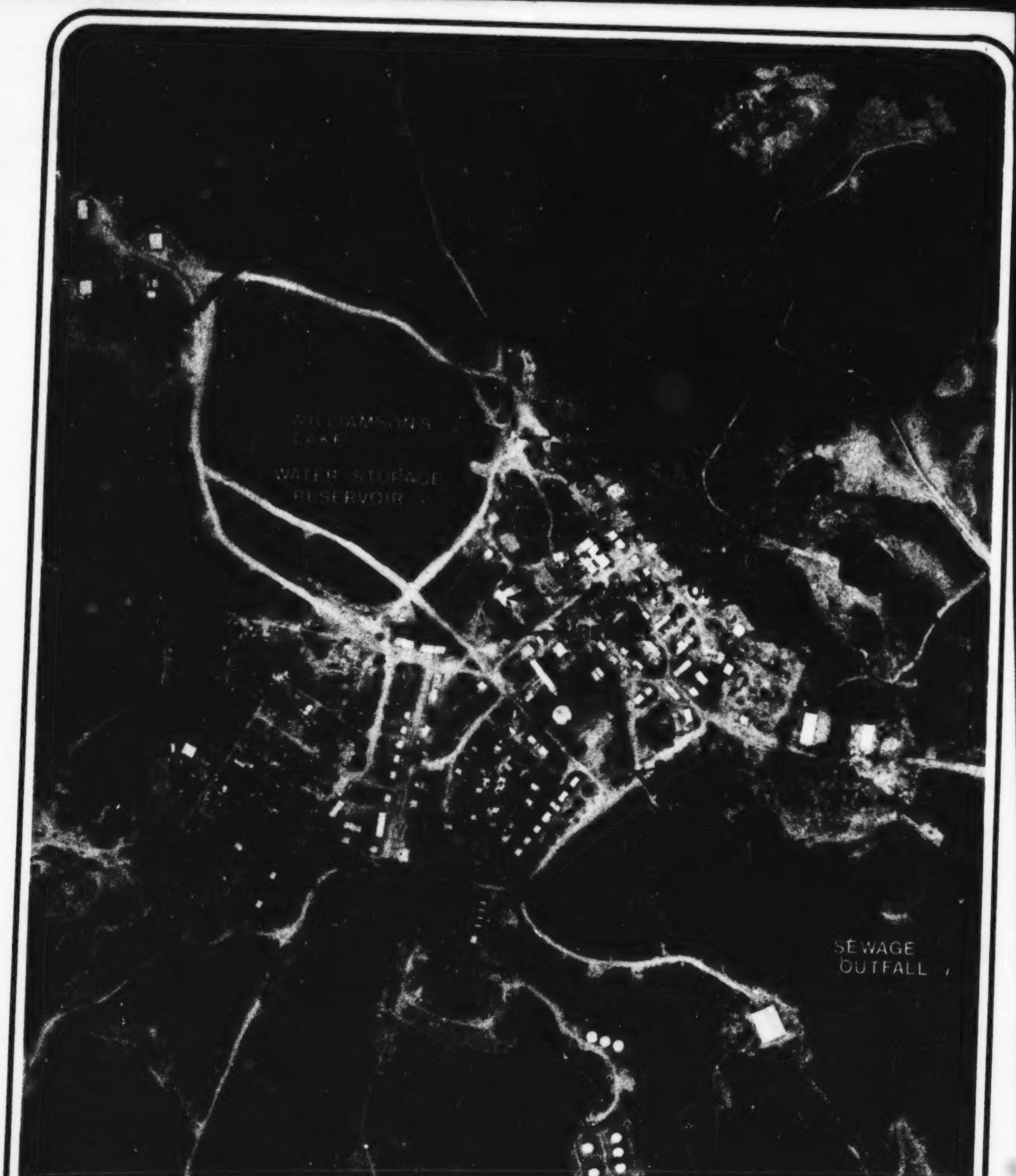
1. Makale, Holloway & Associates Ltd., *Eskimo Point Development Plan,* March, 1978.

2. Associated Engineering Services Ltd., *Water Quality at Eskimo Point, N.W.T.,* November, 1977.

3. Neil Bryant, Head, Fort Smith, Keewatin and Baffin Districts, Water Resources, D.I.A.N.D., *Visit of June 1979 to Hamlet of Eskimo Point,* July 12, 1979.

Rankin Inlet




WILLIAMSON'S LAKE
WATER STORAGE RESERVOIR
SEWAGE OUTFALL

RANKIN INLET

SCALE - 1:7,500

N.A.P.L.
NO. A25583 - 49,50,54 & 55 28/7/80

A. GENERAL

A.1 Location

Rankin Inlet is located in a bay on the west coast of Hudson's Bay about 96 air km southwest of Chesterfield Inlet, and 1088 air km east of Yellowknife. The geographical co-ordinates of the community are 62°49'N latitude and 92°05'W longitude.

A.2 History

Inuit families have inhabited the bay area around Rankin Inlet for many years. The community proper was established as a result of North Rankin Nickel Mines Ltd., which came into production in 1957. Until the mine closed in 1962, a wage economy was the basis of the settlement.

During the past years the establishment of a cannery, arts and crafts facilities and a program of natural resource harvesting has assisted in creating a viable settlement.

A.3 Community Information

Rankin Inlet achieved Hamlet status on April 19, 1975. The community population appears to be relatively stable as shown by the following figures:

POPULATION	YEAR
978	1978
956	1979
1007	1980

The economy of the community was formerly based on wages from mining. Most of the non-Eskimo people are employed by various governmental agencies. Territorial Government offices for the Keewatin District were set up in Rankin. The harvest of natural resources and arts and crafts activities also contribute to the employment of people in the community.

A 1500 meter airstrip serves the community.

A.4 Geology and Terrain

The surface material in the immediate vicinity of Rankin Inlet consists of exposed Precambrian Rock and various types of re-worked ground moraine, notably marine terraces. Material around the community is a mixture of organic material and fines. Numerous eskers close to the community can provide good sources of granular materials. The shoreline consists of recently deposited sands and silts. The active layer of permafrost is very shallow, extending to about 0.3 m below the ground surface.

A.5 Vegetation

Tundra vegetation is typical of the area. Hardy grasses grow in most of the soil covered areas while the rock outcrops support lichens. Clusters of small willow bushes grow in well sheltered locations.

A.6 Climate

The mean July high and low temperatures are 13.1°C and 4.5°C respectively. The mean January

Servicing

View of housing and servicing

HDPE sewer and manhole construction (1976)

high and low temperatures are -27.9°C and -35.2°C respectively. Annual precipitation consists of 160.3 mm rainfall and 1181.1 mm snowfall. The prevailing winds are northerly at 20 km per hour.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Source

The source of water for the community is Nipissar Lake situated about 2 km northwest of the Townsite. It has a surface area of about 1 km² and has depths of up to 6 m.

The quality of water is excellent for domestic purposes as shown by the following chemical analysis: (All values in mg/l unless otherwise noted)

Parameter	Value
pH	7.1
Specific Conductance	238 umho/cm
Turbidity	3.3 JTU
Calcium (Ca)	20.0
Hardness ($CaCO_3$)	79.0
Alkalinity ($CaCO_3$)	60.3
Sodium (Na)	23.5
Chloride (Cl)	40.0

(sampled by DIAND Water Resources July 15, 1977)

B.1.2 Intake Facilities

A suction type intake with foot valves is located at Nipissar Lake. The intake suction lines are installed inside insulated heated casings. The casings are heat traced and are also heated by hot water as a back-up system.

Two raw water submersible pumps each with a capacity of 12.7 L/s @ 328 kPa (167 igpm @ 110' TDH)

Water is pumped through a 150 mm diameter transmission main to the treatment station with a 100 mm heating line. Specifications are as follows:

Length: 1830 m
Type: Series 125 Dupont HDPE Sclairpipe
Insulation: Rigid Urethane foam,
60 mm thick on 150 mm pipe,
30 mm thick on 100 mm pipe

B.1.3 Storage

Water is stored in the Williamson Reservoir adjacent to the Town. It has a capacity of 286 x 10^6L when full and a catchment area of 14 ha (35 acres). This reservoir was designed to supply the community's winter needs and to supply peak domestic and fire demands.

B.1.4 Pumping Facilities

Intake and pumping facilities at the Lake Williamson Pumphouse consists of a gravity intake and wetwell system with vertical turbine pumps. Four pumps are installed in two wetwells and have a capacity of 25 L/s at 597 kPa (333 IGPM @ 200′ TDH). Motors are 30 HP electric. This system is sized to provide for the maximum daily demand in 1989 plus 80 L/s (1050 IGPM) fire flow.

Four pairs of pumps circulate water, heating in a heat exchanger, to the 75 mm heating line running to Nipissar Lake.

Pump specifications are as follows:

Capacity: 2.8 L/s @ 209 kPa
(50 IGPM @ 70′ TDH)
Motor: 3 HP, 1750 RPM, 575 Volt,
3-phase, 60 cycle

B.1.5 Treatment

Treatment facilities in the pumphouse consists of two V-notch Wallace & Tiernan gaseous chlorinators located in the Nipissar Pumping Station.

B.2 Water Distribution

B.2.1 Piped System

The Williamson's Lake Pumphouse contains circulation pumps, a hot water boiler, chlorination equipment, a diesel standby generator, valves and controls. Four pumps supply water to the distribution mains for the maximum hour demands and a fire flow of 80 L/s. The piped water system consists of older utilidors and newer buried mains.

The utilidors consist of 150 mm P.V.C. water lines housed with 150 mm P.V.C. sewer mains in a 600 mm galvanized corrugated metal pipe. The utilidor is covered by 50 mm of urethane insulation and is shallow buried. Heating cables are not provided.
Newer mains are shallow buried to a depth of about 1 m. They consist of HDPE pipe with 50 mm to 75 mm of urethane insulation. Most of the lines are 200 mm in diameter. The primary heating system is provided by the continuous flow of heated water. Emergency heating is provided by thaw tubes.

Service connections to buildings consist of two 25 mm series 160 polyethylene water pipes for a recirculating water service and a 25 mm polyethylene heating cable conduit with a 13 W/m heating cable. A 100 mm series 60 polyethylene sewer line is also attached. This bundle of pipe is insulated by 75 mm of urethane.

B.2.2 Trucked System

Buildings not connected to the circulation system receive water by truck delivery system. Delivery is handled by the Hissarvik Co-Op. Water delivery is provided 5 days a week.

B.3 Sewage Collection

B.3.1 Piped System

The buildings connected to the utilidor and buried mains are served by 150 mm P.V.C. line in the utilidors, and by 150 mm HDPE insulation lines in the buried mains.

B.3.2 Bagged Sewage Pick-Up

All of the housing units not serviced by the utilidor or buried mains are equipped with chemical toilets utilizing polyethylene disposable containers. The bagged sewage is collected by truck in conjunction with garbage collection, and disposal is in the solid waste landfill.

B.4 Sewage Disposal

A macerator is located at the eastern edge of the community by the shore. A 250 mm diameter outfall extends 425 m into the ocean. The outfall is insulated by 25 mm of urethane foam. The macerator is manufactured by Chittenden and Howard Ltd. and is capable of handling up to 35 L/s (460 IGPM).

B.5 Solid Waste

B.5.1 Collection

Refuse is deposited in 205 L drums located in front of the housing units for pick-up by truck on a regular basis. Plastic sewage bags are generally placed on the ground beside the drums.

B.5.2 Disposal

The garbage dump is located about 1 km to the south of the settlement in an area of till material. Garbage is regularly burned and covered. The present site is well situated from the point of view of distance from the settlement, prevailing winds and surface drainage. Larger solid wastes such as metals are separated from the rest of the garbage material.

B.6 Roads

The majority of the roads in the Town are adequate for the present traffic being carried.

B.7 Surface Drainage

Site drainage is relatively good with a strong pattern directly east to the bay and also to the north and south to stream systems also leading to the bay. Wet surface conditions throughout the summer occur due to permafrost conditions. Seepage losses from Williamson's Lake Reservoir cause severe site drainage difficulties, particularly during the early winter.

B.8 Fire Protection

Fire protection in Rankin Inlet consists of the following:

- multi-zone system consisting of call boxes connected to an annunciator panel in a central building;
- one 1976 wheeled triple combination pumper capable of pumping over 34 L/s (450 IGPM); and
- 18 volunteers.

B.9 Other Services

Other services include 2 R.C.M.P. costables, a nursing station, a community centre and a bank. Power is provided by NCPC using diesel generating facilities.

INFORMATION SOURCES

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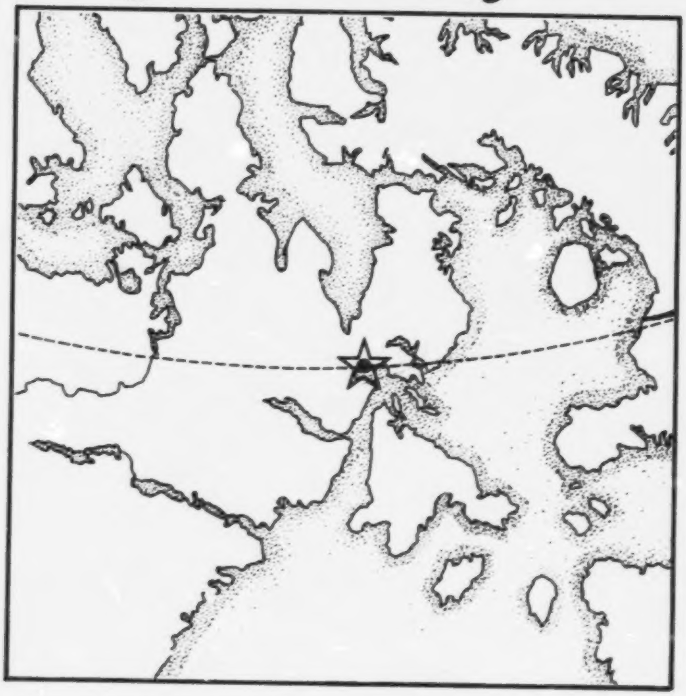
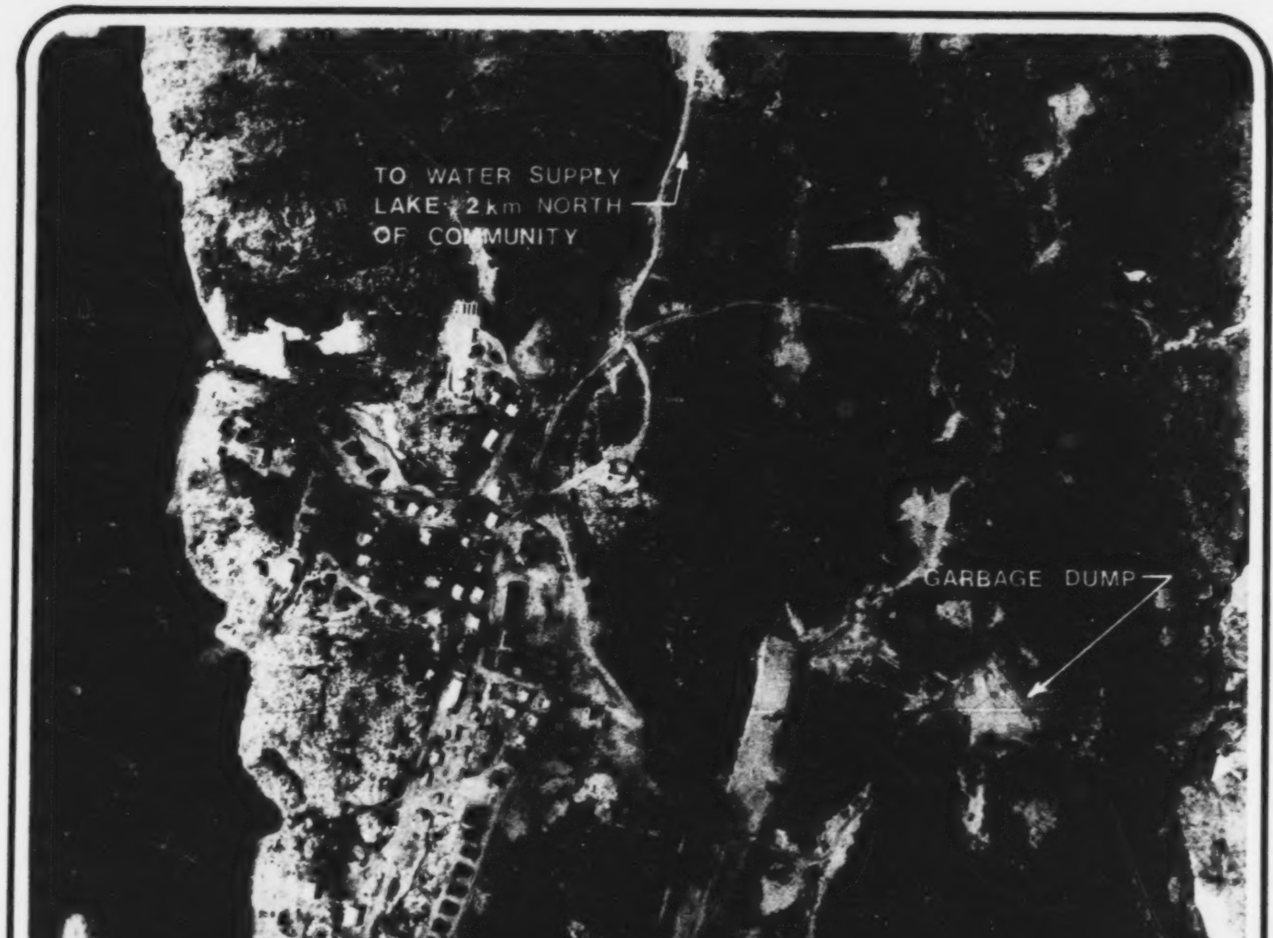
2. Underwood McLellan & Associates Ltd., *Existing Water Supply and Sewage Disposal Facilities with Proposed Improvements,* January, 1977.

3. Underwood McLellan (1977) Ltd., *Study of Sewage Treatment and Disposal at Rankin Inlet,* January, 1979.

Unique residence

Repulse Bay




TO WATER SUPPLY
LAKE 2 km NORTH
OF COMMUNITY
GARBAGE DUMP

REPULSE BAY

SCALE - 1:7,500
N.A.P.L.
NO. A25028-5 7/78

Aerial view

A. GENERAL

A.1 Location

The Hamlet of Repulse Bay is located on the northern shore of Repulse Bay on the south shore of the Rae Isthmus. It has geographical coordinates of 66°32'N and 86°15'W. Repulse Bay is 440 km southeast of Spence Bay and 1416 air km northeast of Yellowknife.

A.2 History

Repulse Bay was first visited by Europeans in 1741 and 1742. In 1853, Dr. John Rae travelled by dogsled from his base at Repulse in an effort to complete the survey of Boothia Peninsula.

The Hudson's Bay Co. established the first trading post in 1916. Revillion Freres, a French trading company, followed in 1923. A Roman Catholic mission arrived in 1932.

Modern development started in the early 1960's with the introduction of rental homes.

A.3 Community Information

Repulse Bay achieved Hamlet status on July 1, 1978. The population has grown slighty over the past two years as shown by the following figures:

POPULATION	YEAR
295	1978
328	1979
326	1980

Community services include a nursing station, a primary school (Kindergarten - Grade 8), Anglican and Roman Catholic churches and a community centre.

The economy is based on sealing, fishing, hunting and carving.

A 1070 m x 30 m gravel surfaced runway is located east of the community at a height of 15 m A.S.L.

Stone Arch

A.4 Geology and Terrain

The predominant features of the Repulse Bay area are hills and valleys carved out of the bedrock. The bedrock fluting is extensively fractured resulting in complex drainage patterns.

Little soil exists in the area except for valley or beach deposits. The valley deposits are generally poorly drained silty sand and gravel. Course aggregate can generally be found as small beach deposits on the top or sides of valley walls.

A.5 Vegetation

Repulse Bay is located well above the tree line. Vegetation consists of mosses and lichens and flowering plants.

A.6 Climate

The mean high and low temperatures for July are 15.7°C and 5.8°C respectively. The January mean high and low are -29.4°C and -36.4°C. Precipitation consists of 150 mm of rainfall and 582 mm of snowfall. Prevailing winds are northerly at 22 km/hr.

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Source

The present source of water is a lake located 2 km north of the community.

It is a relatively large lake and seems capable of providing enough water to meet the Hamlet's future needs. A typical water quality analysis as sampled by M.M. Dillon Ltd., October, 1979, is as follows:(NOTE: All values in mg/l unless otherwise indicated)

PARAMETER	
Total Hardness (as $CaCO_3$)	78.3
Total alkalinity (as $CaCO_3$)	85.1
Suspended solids	12
Total phosphate (PO_3)	<0.016
Turbidity	2 (NTU)
Colour	12 units
Fluoride (F)	<0.1
Dissolved Oxygen	22
Total Iron (Fe)	0.07
Mercury (Hg)	<0.02 (ppb)

Although the water is generally satisfactory from a chemical standpoint, suspended sediment levels are sometimes high during the summer months.

Some local people also make use of melted ice as a source of domestic water.

B.1.2 Water Distribution

Presently the truck is filled directly from the lake. During the winter the truck is driven onto the lake and is filled from the middle of the west bay. In summer months, water is obtained along the shoreline near the end of the road. Water is pumped to the truck tank using pumping facilities located on the delivery truck.

Water delivery truck

Chlorination is achieved by the addition of Javex to the water delivery truck.

Repulse Bay is now under a fully trucked water distribution system contracted by the Hamlet Council. The 1975 model delivery truck has a capacity of 4500 L (1000 Igal) and makes 30 - 40 trips per week. Based on this, consumption is approximately 10 Lpcd.

B.2 Sewage Collection and Disposal

Repulse Bay is on a fully bagged sewage system. Bagged sewage wastes are collected twice a week along with the garbage. Sewage bags are disposed of along with the garbage at the local dump. Garbage is sometimes burned but is not compacted or covered.

B.3 Solid Waste

Garbage is collected and disposed of with the bagged sewage. It is planned to continue to use the present dump site for solid waste as a landfill site.

B.4 Roads

Roads are gravel surfaced and are generally satisfactory for the few vehicles that are used within the community.

B.5 Fire Protection

Fire protection in Repulse Bay consists of the following:

- one centrally located siren;
- an 8 man volunteer fire brigade; and
- 160 kg dry chemical extinguisher.

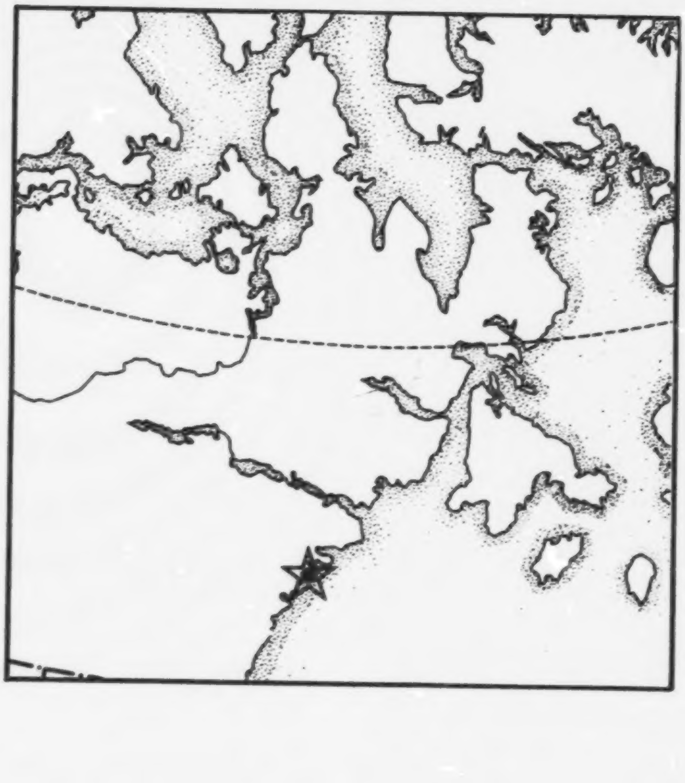
B.6 Other Services

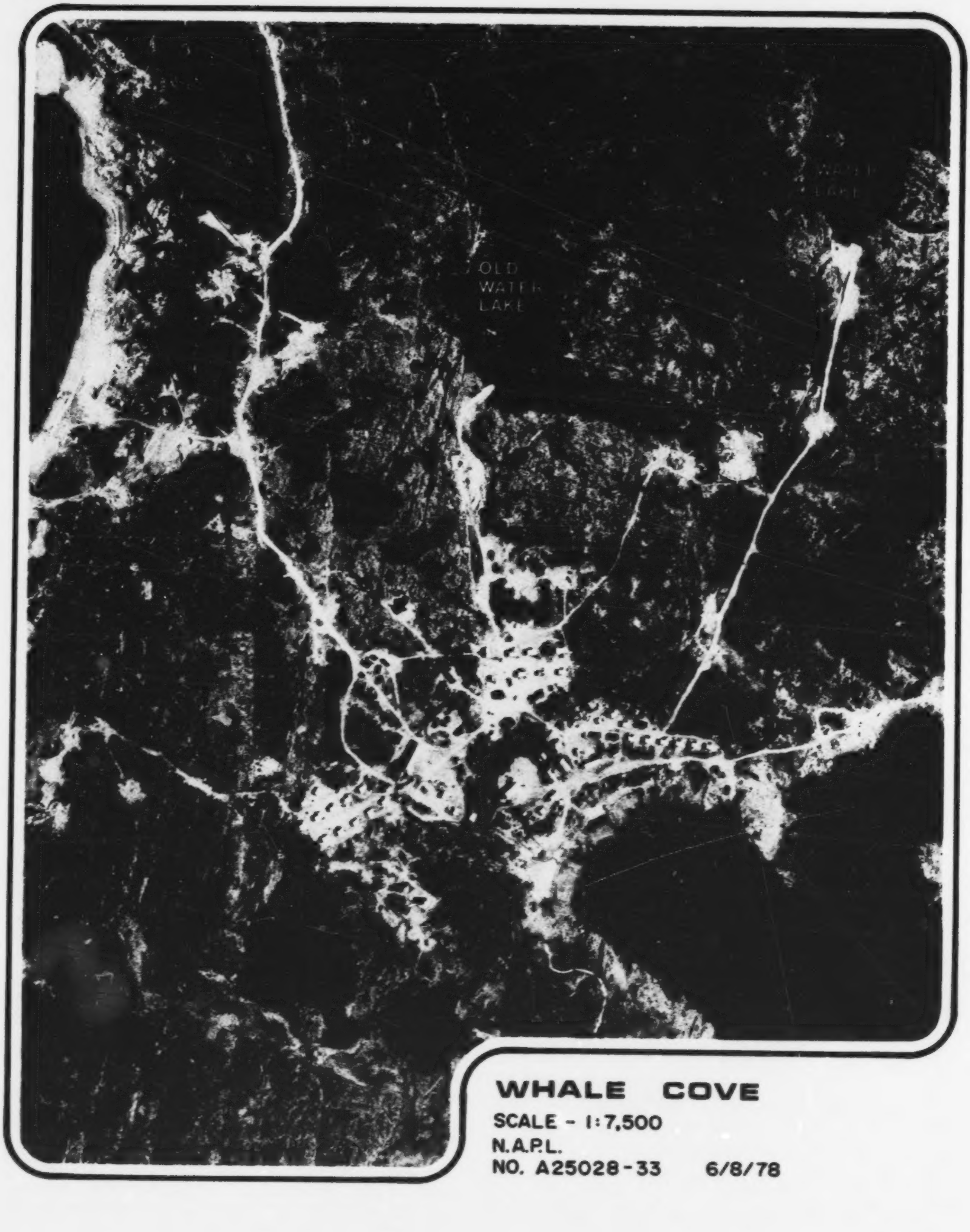
Other services include telephone service by Bell Canada and weekly mail service. Power is provided by NCPC using diesel generating facilities.

INFORMATION SOURCES

M.M. Dillon Ltd., *Repulse Bay Water Supply, Sewage and Solid Waste Disposal,* Evaluation of Alternatives, March, 1980.

Whale Cove




OLD WATER LAKE
WATER LAKE

WHALE COVE
SCALE - 1:7,500
N.A.P.L.
NO. A25028-33 6/8/78

Winter scene of houses

A. GENERAL

A.1 Location

Whale Cove is located on the west coast of Hudson's Bay at geographical co-ordinates of 62°11'N and 92°36'W. It is 80 km south of Rankin Inlet and 1133 km east of Yellowknife.

A.2 History

The Hudson's Bay Company began trading with people in the area during the 1700's. Whale Cove was officially established in 1959 by the Department of Northern Affairs as a way of absorbing the survivors of inland hunting camps where the people had starved in significant numbers during 1957 and 1958.

A.3 Community Information

Whale Cove achieved Hamlet status on July 1, 1976. The community's population has been fluctuating slightly in recent years as indicated by the following figures:

POPULATION	YEAR
201	1978
203	1979
169	1980

The community consists of about 92% native peoples.

The economy of the Hamlet is based on seal hunting, trapping, fishing, caribou hunting and some wage employment offered by the government and the local Co-op.

Community services include a nursing station, a church, a primary school (kindergarden to grade 8) and a community centre. A 1,220 m x 30 m gravel surfaced runway is located northwest of the community.

A.4 Geology and Terrain

Whale Cove lies in a south facing sheltered cove, set on a grassy boulder studded area which gently rises inland. It is surrounded by a ridge of precambrian rock, rising to an elevation of 15-20 m.

The grassy area on which the community is located has a boulder strewn overburden of coarse gravel and sand up to 1 m deep. It is overlain by a thin layer of organic soil. The active layer of permafrost extends to about 1 m.

A.5 Vegetation

Mosses, lichens and hardy grasses comprise the vegetation found in this region.

A.6 Climate

The mean July high and low temperatures are 13.1°C and 4.5°C while the mean January high and low temperatures are -27.9°C and -35.2°C respectively. Precipitation consists of 160 mm rainfall and 1181 mm of snowfall. Prevailing winds are from the northwest at about 20 km/hr.

Water Supply Lake

B. MUNICIPAL SERVICES

B.1 Water Supply

B.1.1 Source

The present source of the community's potable water is Water Lake located about 400 m east of the community. This lake contains water at sufficient depth to maintain a year-round supply. It is readily accessible and of good quality as indicated by the following chemical analysis: (NOTE: All values in mg/L unless otherwise indicated)

PARAMETER	VALUE
Colour	5 (TCU)
Turbidity	.78 (JTU)
pH	7.5
Chromium (Cr)	<0.01
Alkalinity (as $CaCO_3$)	49.0
Phosphates (PO_4)	<0.05
Total Dissolved Solids	96
Total Hardness (as $CaCO_3$)	55.0
Fluoride (F)	<0.1

(W.L. Wardrop and Associates, 1979)

B.1.2 Treatment

Approximately 6 oz. of a 5% chlorine solution such as Javex is added to each 4550 L tankful of water on the truck for disinfection purposes.

B.2 Water Distribution

A 4550 L (1000 lgal) 1976 model wheeled truck is used to distribute water to the community. Water is pumped directly into the truck tank using a truck mounted pump.

B.3 Sewage Collection and Disposal

The whole community is on a system of bagged sewage collection. These are regularly placed outside and are collected along with the garbage. Bagged sewage is deposited at the existing garbage dump. Greywater is disposed of on the ground within the community.

B.4 Solid Waste

Garbage is regularly collected with a 1977 4 wheel drive truck. Householders place their garbage in 205 L drums outside the homes. It is disposed at a site 600 m northeast of the community.

B.5 Roads and Drainage

Roads are generally in satisfactory condition due to available gravel supplies and because the base is generally good. Since most of the community is built on sandy soils, drainage is relatively good. Some ponding occurs which creates a potential health hazard in the spring when the greywater melts.

Garbage disposal area

B.6 Fire Protection

Fire protection in Whale Cove consists of the following:

- call boxes throughout the community directly connected to a siren
- 160 kg dry chemical extinguisher
- 10 person volunteer fire brigade

B.7 Other Services

Other services include radio, mail delivery, and telephone service by Bell Canada. Power is supplied by NCPC with diesel generation facilities.

INFORMATION SOURCES

1. Andrew Taylor & Associates Ltd., *Whale Cove, Town Planning, Water Supply, and Sewage Disposal,* 1962.

2. W.L. Wardrop & Associates Ltd., *Whale Cove Pre-design Study,* December, 1979.

LIST OF COMMUNITIES

Aklavik
Arctic Bay
Arctic Red River
Baker Lake
Broughton Island
Cambridge Bay
Cape Dorset
Chesterfield Inlet
Clyde River
Colville Lake
Coppermine
Coral Harbour
Detah
Enterprise
Eskimo Point
Fort Franklin
Fort Good Hope
Fort Liard
Fort McPherson
Fort Norman
Fort Providence
Fort Resolution
Fort Simpson
Fort Smith
Frobisher Bay
Gjoa Haven
Grise Fiord
Hall Beach
Hay River
Hay River Indian Reserve
Holman
Igloolik
Inuvik
Jean Marie River
Kakisa Lake
Lac La Martre
Lake Harbour
Nahanni Butte
Nanisivik
Norman Wells
Pangnirtung
Paulatuk
Pelly Bay
Pine Point
Pond Inlet
Rae Edzo
Rae Lakes
Rankin Inlet
Repulse Bay
Resolute Bay
Sachs Harbour
Sanikiluaq
Snare Lake
Snowdrift
Spence Bay
Trout Lake
Tuktoyaktuk
Whale Cove
Wrigley
Yellowknife

ABBREVIATIONS

A.S.L.	above sea level
BOD_5	5--day biochemical oxygen demand
°C	degrees Centigrade
HDPE	high density polyethylene
igal	imperial gallons
igpcd	imperial gallons per capital per day
JTU	Jackson Turbidity Units
km	kilometer
kPa	kilopascals
<	less than
L	litres
lpcd	litres per capita per day
Lpm or L/m	litres per minute
Lps or L/s	litres per second
m	metre
mg/l	milligrams per litre
mm	millimeter
M.S.L.	mean sea level
PVC	polyvinyl chloride
SS	suspended solids
TDH	total dynamic head
wm	water main

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The following is a list of general information sources used in many of the inventory reports.

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2. Statistics Section, Department of Planning and Program Evaluation, Government of the Northwest Territories. *Population Projections, Community Tabulations, Northwest Territories, 1978 to 1988.*
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4. Northern Canada Power Commission. Utility Service Rate Schedules for 1980.
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6. Government of the Northwest Territories. *Community Profiles.* August 14, 1979.
7. Department of Local Government, Government of the Northwest Territories. *Water and Sanitation Project Costs, A Consolidation of Historical Cost Information.* October, 1977.
8. Department of Local Government, Government of the Northwest Territories. *Water and Sanitation, Operation and Maintenance Costs.* September, 1978.
9. Research Institute of Northern Canada. *Canada North Almanac.* 1977.

10. Ministry of Transport, the Chief of Defense Staff. *Northern Supplement Canada North of 60°N*, Aerodromes, Radio Aids and Associated Chart Data, Y.T., N.W.T., and Northern Quebec, May 15, 1980. Produced by Department of Energy, Mines and Resources.
11. Government of the Northwest Territories. Correspondence, memos and reports from files of the Departments of Local Government and Highways and Public Works.
12. *Settlements of the Northwest Territories.* Descriptions prepared for the Advisory Commission on the Development of Government in the N.W.T., Book I, Ottawa, 1966.
13. Department of Local Government, G.N.W.T. *Schedule of 1980/81 Contracts for Municipal Services* April, 1980.
14. G.W. Heinke, E.J. Bowering, University of Toronto. *Fire Protection and Prevention in Communities of the Northwest Territories and Yukon Territory.* Interim Report No. 1, April, 1980.

PHOTOGRAPHIC CREDITS

Baffin Region

Arctic Bay
i) N. A. Jacobsen
ii) V. Christensen
iii) N. A. Jacobsen

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ii) Rick Douglas
iii) V. Christensen
iv) V. Christensen
v) Mike Sims

Cape Dorset
i) GNWT — Information
ii) Mike Sims
iii) Vern Christensen

Clyde River
i) Jack Grainge
ii) V. Christensen

Frobisher Bay
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ii) GNWT — Information
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v) V. Christensen
vi) V. Christensen

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iii) V. Christensen

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i) GNWT — Information
ii) Peter Cook
iii) GNWT — Public Works
iv) V. Christensen

Nanisivik
i) Wagne Starling
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iv) V. Christensen
v) V. Christensen

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Nahanni Butte
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Pine Point
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iii) M. McBride
iv) M. McBride
v) M. McBride
vi) M. McBride

Rae Lakes
i) GNWT — Public Works
ii) V. Christensen
iii) V. Christensen

Rae-Edzo
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ii) GNWT — Information
iii) V. Christensen

Snowdrift
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ii) A. G. Redshaw

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ii) Outcrop Ltd.

Wrigley
i) N. A. Jacobsen

Yellowknife
i) N. A. Jacobsen
ii) N. A. Jacobsen
iii) N. A. Jacobsen
iv) V. Christensen

Inuvik Region

Aklavik
i) GNWT — Information
ii) N. A. Jacobsen

Arctic Red River
i) John Reid
ii) B. Milburn
iii) V. Christensen

Colville Lake
i) GNWT — Information

Fort Franklin
i) A. G. Redshaw
ii) GNWT — Public Works

Fort Good Hope
i) V. Christensen
ii) A. G. Redshaw
iii) A. G. Redshaw
iv) John Reid
v) GNWT — Public Works

Fort McPherson
i) V. Christensen
ii) John Reid
iii) V. Christensen

Fort Norman
i) Bruce Doulton
ii) GNWT — Information
iii) M. McBride
iv) V. Christensen
v) M. McBride

Inuvik
i) N. A. Jacobsen
ii) N. A. Jacobsen
iii) A. G. Redshaw
iv) V. Christensen
v) N. A. Jacobsen
vi) N. A. Jacobsen

Norman Wells
i) V. Christensen
ii) N. A. Jacobsen
iii) V. Christensen
iv) V. Christensen
v) M. McBride
vi) V. Christensen
vii) M. McBride
viii) M. McBride
ix) M. McBride

Paulatuk
i) John Reid
ii) John Reid

Sachs Harbour
i) Outcrop Ltd.
ii) John Reid
iii) Outcrop Ltd.

Tuktoyaktuk
i) Anne McKillican
ii) A. G. Redshaw
iii) N. A. Jacobsen
iv) N. A. Jacobsen
v) John Reid
vi) B. Milburn
vii) V. Christensen

Keewatin Region

Baker Lake
i) A. G. Redshaw
ii) J. J. Cameron
iii) J. J. Cameron
iv) B. Milburn

Chesterfield Inlet
i) J. J. Cameron
ii) J. J. Cameron

Coral Harbour
i) J. J. Cameron

ii) J. J. Cameron
iii) GNWT — Public Works

Eskimo Point
i) GNWT — Public Works
ii) V. Christensen
iii) J. J. Cameron

Rankin Inlet
i) GNWT — Public Works
ii) V. Christensen
iii) V. Christensen
iv) J. J. Cameron
v) V. Christensen

Repulse Bay
i) V. Christensen
ii) V. Christensen
iii) V. Christensen

Whale Cove
i) GNWT — Public Works
ii) J. J. Cameron
iii) J. J. Cameron

NOTE: Numbers beside name corresponds with order of appearance.